OFFICERS OF THE CORPS OF ENGINEERS, U. S. ARMY.

STATEMENT SHOWING THEIR RANK, DUTIES AND ADDRESSES, JANUARY, 1882.

Brigadier General and Chief of Engineers.

HORATIO G. WRIGHT, Bvt. Major General, Washington, D. C.—In command of the Corps of Engineers and in charge of the Engineer Department. Charged with the supervision of such matters connected with construction of jetties and other works at South Pass, Mississippi River, as require the action of the Secretary of War.

Member of Joint Commission to supervise the construction of the Washington National Monument. Member of Light-House Board. Directed by the President to co-operate with the authorities of the State of New York in examining and deciding upon exterior pier and bulkhead lines on Hudson River from State dam at Troy to the city of Hudson.

Colonels.

HENRY W. BENHAM, Bvt. Major General, 7 Waverly Place, New York City.—In charge of the construction of Forts Winthrop, Independence and Warren; work on Long Island Head, and field works on the coast from Provincetown to Gloucester, Mass.; Forts Montgomery, Columbus, Wood and Hamilton and additional batteries, Castle Williams, South Battery, Governor's Island, Mortar Battery at Fort Hamilton, N. Y., and fort at Sandy Hook, N. J.

JOHN N. MACOMB, 1,125 Girard street, Philadelphia, Pa.—In charge of the construction of Forts Delaware, Del., and Mifflin, Pa., battery at Finn's Point, N. J., and work opposite Fort Delaware, Del.

Chairman of Commission Advisory to Board of Harbor Commissioners of Philadelphia.

Z. B. TOWER, Bvt. Major General, Army Building, New York City.—President of the Board of Engineers.

Member of Board of Engineers on improvement of Charleston Harbor, S. C.; of Board of Engineers on improvement of Pass Cavallo Inlet, Aransas Pass and Bay, and entrance to Galveston Harbor, Tex.; of Board of Engineers on improvement of Savannah River and Harbor, Ga., and Member of Board of Officers on inventions of Heavy Ordnance and Projectiles, etc., in accordance with act of Congress approved March 3, 1881.

JOHN NEWTON, Bvt. Major General, Army Building, New York City.—Member of the Board of Engineers, in charge of the improvement of the Harbors at New York, Rondout, Port Chester, New Rochelle, and of Echo Harbor, N. Y.

In charge of the improvement of the Hudson River, Harlem River, Flushing, Sheepshead and Canarsie bays, East Chester and Newtown creeks, and Buttermilk Channel, channel in Gowanus Bay, and Sumpawaums Inlet, N. Y., South and Raritan rivers and Cheesequakes Creek, N. J.; removal of obstructions in the East River, including Hell Gate, N. Y.

In charge of the manufacture and supply of Mastic, and examination of Brooklyn Bridge, N. Y.

Member of Board of Engineers on improvement of Charleston Harbor, S. C.; of Board of Engineers on improvement of Pass Cavallo Inlet, Aransas Pass and Bay, and entrance to Galveston Harbor, Texas; of Board of Engineers on improvement of Savannah River and Harbor, Ga., and of Court of Inquiry upon Lieutenant Colonel Warren's conduct as Major General commanding the Fifth Army Corps at battle of Five Forks, Va., on April 1, 1865. Directed by the President to co-operate with the authorities of the State of New York in examining and deciding upon exterior pier and bulkhead lines on Hudson River from State dam at Troy to the City of Hudson.

GEORGE THOMAS, Bvt. Brig. General, Box 1989, Portland, Me.—In charge of the improvement of the Harbors at Belfast, Portland, Rockland, Richmond (Kennebec River), Richmond's Island, Me., Portsmouth, N. H., Newburyport, Boston (including sea-walls on Point Allerton, Great Brewster Island, Lovells' Island, Long Island Head, Rainsford Island, and Deer Island, also channel leading to Nantasket Beach), Plymouth, Provincetown and Scituate, Mass.

In charge of the improvement of the rivers Saint Croix (repairing breakwater near Calais), Cathance, Back (at "Gut" opposite Bath), and Kennebunk, Me., Lamprey and Exeter, N. H., Merrimac, Mystic and Charles, Mass., Lubec Channel, Moose-a-bec Bar at Jonesport, Me., and of Lake Winnipiseogee, N. H.

In charge of the examination or survey of Harbor of Brunswick, on the Androscoggin River, Me., Channel of Harrisecket River from Weston's Point to Freeport Landing in Freeport, Me.; Merrimac River from Lawrence, Mass., to Manchester, N. H.; and Lynn Harbor, Mass.

WILLIAM F. RAYNOLDS, Bvt. Brig. General, 532 Walnut St., Phila., Pa.—On detached service; Engineer 4th Light-house District.

Lieutenant Colonels.

CHARLES S. STEWART, San Francisco, Cal. In charge of the construction of fortifications at Fort Point, Point San Jose, and Angel Island, in San Francisco Bay, and at San Diego, Cal.

In charge of the improvement of the Harbor at San Diego, Cal. Senior Member of Board of Engineers for the Pacific Coast.

CHARLES E. BLUNT, Bvt. Colonel, Portland, Me.—In charge of the construction of forts Gorges, Preble, Scammel, Popham, Knox and battery at Portland Head, Me., and forts Constitution and McClary, and batteries on Jerry's Point and Gerrish's Island, Portsmouth Harbor, N. H. Engineer 1st and 2d Light-house districts.

JAMES C. DUANE, Bvt. Brig. General, P. O. Box 2128, New York City.—On detached service. Engineer 3d Light-house District.

ROBERT S. WILLIAMSON, San Francisco, Cal.—Member of Board of Engineers for the Pacific Coast. Engineer 12th Lighthouse District.

QUINCY A. GILLMORE, Bvt. Major General, P O. Box 1647, New York City.—In charge of the construction of forts Wadsworth, Tompkins and its batteries, N. Y.; Monroe and Wool, Va.; Macon and Caswell, N. C.; Moultrie, Sumter, Johnson and Castle Pinckney, S. C.; Jackson and Pulaski, Ga.; Clinch and Marion, Fla.

In charge of the improvement of the Harbors at Charleston, S.C.; Savannah and Brunswick, Ga.

In charge of the improvement of Ashley River and Wappoo Cut, S. C.; of the bar at the mouth of St. John's River, and of the inside passage between Fernandina and St. John's, Fla.; Volusia Bar, Fla.; Cumberland Sound, Fla. and Ga.; Savannah and Altamaha rivers and St. Augustine Creek, Ga.

In charge of the examination or survey for opening of steamboat communication from the Saint John's River, Fla., by way of Topokalija Lake, to Charlotte Harbor or Pease Creek; of Savannah River and Harbor, Ga., and Indian River, Fla.

Member of Board of Engineers on improvement of Charleston Harbor, S. C.; of Board of Engineers on improvement of Pass Cavallo Inlet, Aransas Pass and Bay and entrance to Galveston Harbor, Tex.; of Board of Engineers on improvement of Savannah River and Harbor, Ga. Member and President of "The Mississippi River Commission," created by Act of Congress, approved June 28, 1879.

THOS. LINCOLN CASEY, Bvt. Colonel, Washington, D. C.—In charge of the construction of the building for the State, War and Navy departments; of the Washington Aqueduct and the construction of the Washington National Monument.

JOHN G. PARKE, Bvt. Major General, Washington, D. C.—In charge of the 3d Division, office of the Chief of Engineers.

GOUVERNEUR K. WARREN, Bvt. Major General, Newport, R. I.—In charge of the construction of Defenses of New Bedford Harbor, Mass., and Narragansett Bay, R. I.

In charge of the improvement of the Harbors of Nantucket, Hyannis, Wareham and Wood's Holl, Mass.; Newport and Block Island, R. I.

In charge of the improvement of the Rivers Taunton, Mass.; Pawtucket, Providence and Potowomut, R. I., and Connecticut, Mass. and Conn.; Narragansett Bay, R. I., and Little Narragansett Bay, R. I. and Conn.

In charge of the examinations or surveys of Edgartown Harbor and South Beach, and Buzzard's and Barnstable bays, Mass., at entrance of proposed Cape Cod Canal.

Member of Board of Engineers upon bridging the Ohio River.

GEORGE H. MENDELL, Bvt. Colonel, San Francisco, Cal.—In charge of the construction of the fort on Alcatraz Island and of defenses at Lime Point, San Francisco Bay.

In charge of the improvement of the harbor at Oakland, Humboldt Harbor and Bay and of the construction of the breakwater at Wilmington Harbor, Cal.

In charge of the improvement of Sacramento and San Joaquin rivers and Petaluma Creek, Cal.

In charge of the examination or survey of Mokelumne River, Cal., from its mouth at or near Woodbridge; to devise a system of works to prevent further injury to navigable waters of California from the débris from the mines, with estimates of the costs of such works.

To investigate causes tending to decrease depth of water and diminish the commercial value of San Francisco Harbor.

Member of Board of Engineers for the Pacific Coast.

HENRY L. ABBOT, Bvt. Brig. General, Whitestone, N. Y.—Member of the Board of Engineers.

In charge of the construction of Fort Schuyler and fort at Willets Point, N. Y., and of experiments with torpedoes.

Commanding Engineer Depot and Post of Willets Point, Engineer School of Application and Battalion of Engineers.

WILLIAM P. CRAIGHILL, 70 Saratoga St., Baltimore, Md.—In charge of the construction of defenses of Baltimore, Md., and Washington, D. C.

In charge of the improvement of the harbors at Baltimore, Annapolis, Queenstown, and of the inner harbor at Cambridge, Md., and Onancock harbor, Va.

In charge of the improvement of the channel of Susquehanna River above and below Havre de Grace, and work at the Fishing Battery light station near Spesutia Island; of the Chester, Wicomico, Pocomoke, Elk, Northeast, and Choptank rivers, Treadhaven and Secretary creeks, and water passage between Deal's Island and Little Deal's Island, Md.; Broad Creek, Del.; James and Appomattox rivers, Va.; New River, Va. and W. Va., Great Kanawha, Shenandoah and Elk rivers, W. Va., and Cape Fear River, N. C.

In charge of the examination or survey of channel of Broad Creek, west side of Kent Island, Corsica Creek, upper thoroughfare leading into Tangier Sound, Deil's Island and Rock Creek, Md., and of survey of James River to ascertain the practicability and cost of procuring a channel 25 ft. at full tide, from Richmond to mouth of river; Skipton Creek, Md., and Bush River, Md., from Harford Furnace to Chesapeake Bay. Surveys across the peninsula of Maryland and Delaware to connect by canal the waters of the Delaware and Chesapeake bays.

In charge of the building of the monument at Yorktown, Va.

CYRUS B. COMSTOCK, Bvt. Brig. General, Detroit, Mich.—In charge of the survey of Northern and Northwestern lakes. Member of "The Mississippi River Commission," created by Act of Congress, approved June 28, 1879.

Majors.

GODFREY WEITZEL, Bvt. Major General, Detroit, Mich.—In charge of the construction of harbor of refuge on Lake Huron.

In charge of the Louisville and Portland Canal and of St. Mary's Falls Canal; of the improvement of the Falls of the Ohio, St. Mary's Falls Canal, and of the rivers St. Mary and Detroit, Mich.

In charge of the removal of wreck of steamer Nile from Detroit River.

Member of Board of Engineers upon bridging the Ohio River.

Engineer 11th Light-house District.

ORLANDO M. POE, Bvt. Brig. General, Headquarters of the Army, Washington, D. C.—On detached service, Aide-de-Camp on the personal staff of the General of the Army with the rank of Colonel.

Member of Light-house Board.

Charged with the sale of a portion of Fort Gratiot Military Reservation.

DAVID C. HOUSTON, Bvt. Colonel, Milwaukee, Wis.—In charge of the improvement of the harbors at Milwaukee, Racine and Kenosha, and harbor of refuge at Milwaukee Bay, Wis., and Waukegan, Ill.

In charge of the improvement of the rivers Fox and Wisconsin.

GEORGE H. ELLIOT, Washington, D. C.—In charge of the 1st and 2d Divisions, Office of the Chief of Engineers.

HENRY M. ROBERT, Milwaukee, Wis.—In charge of the improvement of the harbors at Ontonagon, Eagle Harbor, Marquette, Manistique, and harbor of refuge at Grand Marais, Mich.; Menomonee, Green Bay, Ahnepee, Two Rivers, Manitowoc, Sheboygan, Port Washington, Kewaunee, and Oconto, Wis.; and harbor of refuge at entrance to Sturgeon Bay Canal, Lake Michigan.

Advisory Engineer for improvement of Kewaunee Harbor, Wis.

WILLIAM E. MERRILL, Bvt. Colonel, 82 West Third street, Cincinnati, O.—In charge of the construction of ice-harbors at or near Cincinnati, and mouth of Muskingum River, Ohio.

In charge of the improvement of the Ohio River, the Monongahela River, W. Va. and Pa., and the Allegheny River, Pa.

Member of Board of Engineers upon bridging the Ohio River.

Engineer 14th Light-house District.

WALTER MCFARLAND, Oswego, N. Y.—In charge of the construction of Fort Wayne, Mich., and forts Porter, Ontario and Niagara, N. Y.

In charge of the improvement of the harbors at Dunkirk and Buffalo on Lake Erie; Olcott, Oak Orchard, Charlotte, Pultneyville, Big Sodus, Little Sodus, Oswego and Wilson, on Lake Ontario, and Ogdensburg and Waddington on the river St. Lawrence.

In charge of the improvement of Niagara River, N. Y.

ORVILLE E. BABCOCK, Bvt. Brig. General, 1 Courtland street, Baltimore, Md.—On detached service; Engineer 5th Light-house District.

JOHN M. WILSON, Bvt. Colonel, Scofield Block, Cleveland, O.—In charge of the improvement of the harbors at Port Clinton, Monroe, Toledo, Sandusky, Huron, Vermillion, mouth of Black River, Rocky River, Cleveland, Fairport, Ashtabula, Conneaut and Erie, on Lake Erie.

In charge of the improvement of Sandusky River, O.

FRANKLIN HARWOOD, Bvt. Lieut. Colonel, Detroit, Mich.—In charge of the improvement of the harbors at Cheboygan, Au Sable and Sebewaing, on Lake Huron, harbor of Alpena at Thunder Bay, harbors at Charlevoix, Frankfort, Manistee, Ludington, Pentwater, White River, Muskegon, Grand Haven, Black Lake, Saugatuck, South Haven and St. Joseph, and waterchannel leading up to Benton Harbor, and harbor of refuge at Portage Lake, on Lake Michigan.

In charge of the improvement of Saginaw, Grand and Clinton rivers, Michigan, and removing bar at iceharbor of refuge at Belle River, Michigan.

In charge of the examination or survey for harbor at Caseville, Lake Huron.

In charge of St. Clair Flats Canal.

JOHN W. BARLOW, Bvt. Lieut. Colonel, New London, Conn.—In charge of Forts Griswold and Hale, and the construction of Fort Trumbull, Connecticut.

In charge of the improvement of the harbors of New London, Stonington, New Haven, Bridgeport, Milford, Southport and Norwalk, Conn., and Port Jefferson, N. Y.; and of the construction of Breakwater at New Haven, Conn.

In charge of the improvement of the rivers Housatonic and Thames, Connecticut.

In charge of the examination or survey of harbors of Madison and Clinton, Conn., and Greenport and Mamaroneck, N. Y.; and of the survey for breakwater and harbor of refuge at Milford, Conn.

PETER C. HAINS, Bvt. Lieut. Colonel, Charleston, S. C.—On detached service; Engineer 6th Light-house District.

FRANCIS U. FARQUHAR, Bvt. Lieut. Colonel, Office of the Light-house Board, Washington, D. C.—On detached service; Engineer Secretary to Light-house Board.

GEORGE L. GILLESPIE, Bvt. Lieut. Colonel, Room 59, Army Building, New York City.—In charge of the improvement of the harbors of Plattsburg, N. Y., Burlington and Swanton, Vt.

In charge of the improvement of the Ticonderoga River, N. Y.; Shrewsbury, Rahway, Elizabeth, Manasquan and Passaic Rivers, Raritan Bay, and Woodbridge and Mattawah Creeks, N. J.; Otter Creek, Vt., and channel betweenStaten Island and New Jersey.

In charge of the removal of the wreck of bark Samarang, near Sandy Hook, N. J.

In charge of the examination or survey of harbor at Port Henry, Channel between North Hero and South Hero, Lake Champlain, New York Bay between Sandy Hook and Coney Island Point, and from point between Ellis Island and docks of New Jersey Central Railroad to point between Robbins' Reef Light and Constable Hook, New York Bay.

CHARLES R. SUTER, 1351 Washington Avenue, St. Louis, Mo.—In charge of the improvement of the rivers Mississippi and Missouri, removal of snags, etc.; and of the Missouri River at the following localities: St. Charles, Cedar City, Glasgow, Lexington, Kansas City, Fort Leavenworth, Atchison, St. Joseph, Brownville, Nebraska City, Eastport, Plattsmouth, Omaha, Council Bluffs, Sioux City, Vermillion, and from Kansas City to its mouth; and of Gasconade River.

In charge of the examination or survey of Missouri River at or near Arrow Rock, and of Nishnabotana from Hamburg, Iowa, to its junction with the Missouri.

In charge of the survey of the Missouri River from its mouth to Sioux City, Iowa, and to Fort Benton, Mont.

Member of "the Mississippi River Commission," created by Act of Congress approved June 28, 1879.

Member of Board of Engineer Officers on protection of river front at New Orleans, La.

Engineer Fifteenth Light-house District.

JARED A. SMITH, Indianapolis, Ind.—In charge of the improvement of the harbors at Michigan City, Ind., and New Buffalo, Mich.

In charge of the improvement of the rivers Wabash, Ind. and Ill., and White, Ind.

SAMUEL M. MANSFIELD, Bvt. Lieut. Col., Galveston, Tex.—In charge of the improvement of the harbors at Galveston and Brazos Santiago, Tex.

In charge of the improvement of ship channel in Galveston Bay, Pass Cavallo, Aransas Pass and Bay up to Rockport and Corpus Christi, Brazos River, Buffalo Bayou, deepening channel at mouth of Trinity River and removal of obstructions to Liberty, and the protection of river bank at Fort Brown, Tex.

In charge of the examination or survey from Brazos de Santiago through Laguna Madre to Point Isabel, Tex.

GARRIT J. LYDECKER, Columbia Building, Four-and-a-half street, Washington, D. C.—On detached service; Engineer Commissioner of the District of Columbia.

WILLIAM R. KING, Chattanooga, Tenn., in charge of the improvement of the rivers Tennessee, Tenn. and Ala.; Cumberland above and below Nashville, Ky. and Tenn.; Red, Hiwassee, Caney Fork, Obey's, Duck, French Broad, and Clinch, Tenn.; Oostenaula, Coosawattee, Etowah, Oconee, and Ocmulgee, Ga., and Coosa, Ga. and Ala.

In charge of the examination or survey of Chattahoochee River, Ga.; Bear Creek, Little Tennessee River from mouth on the Holston or Big Tennessee River to mouth of Tellico River, and Cumberland River at Smith's Shoals, Ky., to ascertain the practicability and cost of canal, with locks and dams, from the head to foot of said shoals.

WM. H. H. BENYAURD, Memphis, Tenn.—In charge of the improvement of the harbors at Memphis, Tenn., and Vicksburg, Miss.

In charge of the improvement of Tensas River, La.; Ouachita River and Bayou Bartholomew in La. and Ark., and Bayou Bœuf, La., and Cypress Bayou, La. and Tex.; of mouth of the Red River, La., and Upper Red River from Fulton to head of Raft; of the rivers Big Sun Flower, Coldwater, Yazoo, Yallabusha and Tallahatchie, and Tchula Lake, Miss., and the Mississippi River at Memphis, Natchez, Vidalia, and Vicksburg, and the Big Hatchie River, Tenn.; of removal of raft, snags, and other obstructions from Red River and of closing Tones' Bayou.

In charge of the water-gauges on the Mississippi River and its principal tributaries.

In charge of the examination or survey of Bear Creek, running into Yazoo River, and Big Black River, Miss.

Member of Board of Engineer Officers on protection of river front at New Orleans, La.

AMOS STICKNEY, P. O. Drawer 432, New Orleans, La.—In charge of the construction of Forts Jackson, St. Philip, Livingston, Pike, and Macomb, Tower Dupré, Battery Bienvenue, and Tower at Proctorsville, La.

In charge of the improvement of the Harbor at New Orleans, La.

In charge of the improvement of the Amite, Vermilion, Tangipahoa, Tickfaw, Tchefuncte, and Calcasieu rivers, bayous Terrebonne, Teche, Black, and Courtableau, La., Calcasieu Pass., La., Pearl River, Miss., and of removal of obstructions in Bayou La Fourche, La.

In charge of the surveys for a breakwater in Lake Pontchartrain, and the examination or survey of bayous Plaquemine, Grand Caillou, Little Caillou, Fusilier, Grand Lake, Atchafalaya River from Berwick's Bay to mouth of Red River, Bogue Chitto River from its mouth to Franklinton, and Bogue Falia from its mouth to 25 miles above Covington La., West Pearl River, Pass Manchac, and Bayou Manchac, La., from its mouth to the Mississippi River.

Member of Board of Engineer Officers on protection of river front at New Orleans, La.

JAMES W. CUYLER, 82 West Third St., Cincinnati, O.—In charge of the impromement of the Little Kanawha and Guyandotte rivers, W. Va., the Big Sandy River, W. Va. and Ky., and the Kentucky and Tradewater rivers, Ky.

In charge of the examination or survey of Licking River from its mouth to Falmouth, Ky.

Captains.

ALEXANDER MACKENZIE, Rock Island, Ill.—In charge of the improvement of the harbors at Fort Madison and Muscatine, Iowa, Rock Island and Galena, Ill.

In charge of the improvement of the Mississippi River, from St. Paul to Des Moines Rapids; from Des Moines Rapids to the mouth of the Illinois River; at Quincy, Quincy Bay, and Andalusia, Ill.; at Hannibal, Louisiana and Alexandria, Mo.; and of the Upper Mississippi River and Rock Island Rapids and Des Moines Rapids of the Mississippi River; Galena and Cuivre rivers; and of removing bars in Mississippi River opposite Dubuque and Guttenberg, Ia.

In charge of operating the Des Moines Rapids Canal.

In charge of survey for harbor of refuge in Lake Pepin, at Stockholm, Wis., and Lake City, Minn.

OSWALD H. ERNST, 404 Market St., St. Louis, Mo.—In charge of the improvement of Mississippi River between the mouths of the Illinois and Ohio rivers, and at Cape Girardeau, and Minton's Point, Mo., and of Osage River in Missouri and Kansas.

In charge of construction of Ice-harbor at St. Louis, Mo., and improvement of harbor and Mississippi River at Alton.

In charge of the examination or survey of Fish Bend near Fort Chartres, Mississippi River.

Member of Board of Engineer Officers on protection of river front at New Orleans, La.

DAVID P. HEAP, temporarily care Messrs. Munroe & Co., No. 7 Rue Scribe, Paris, France.—On leave of absence.

WILLIAM LUDLOW, Bvt. Lieut. Colonel, 1125 Girard St., Philadelphia, Pa.—In charge of the improvement of the harbors at Wilmington, Del., Chester, Pa., and at other places on Delaware River and Bay, ice-harbors at Marcus Hook, Pa., and Newcastle, Del., and of the construction of pier near Lewes, Del.

In charge of the improvement of the Salem and Rancocas rivers and Cohansey Creek, N. J.; Delaware, Christiana, Broadkiln, and St. Jones rivers, Duck and Mispillion creeks, Del.; Chester Creek, Schuylkill River and Susquehanna River from Richard's Island up, Pa.; and Delaware River, below Bridesburg, Pa.; between Bridesburg and Trenton; near Cherry Island Flats, and at Schooner Ledge.

In charge of the examination or survey of Frankford Creek from its mouth in Delaware River to Frankford Avenue, Five Mile Point below Bridesburg, mouth of Mispillion and Murder Kiln creeks and Indian River, Del., Newton and Mantua creeks, and Maurice, Salem and Cohansey rivers, N. J.; Delaware River, harbor at Delaware Breakwater, Delaware River below League Island, and Ice-harbor at the head of Delaware Bay near Morris Liston's or Reedy Island.

WILLIAM A. JONES, Presidio of San Francisco, San Francisco, Cal.—On detached service; Engineer Officer, Military Division of the Pacific and Department of California.

ANDREW N. DAMRELL, Bvt. Major, Mobile, Ala.—In charge of the construction of defenses of Mobile, Ala., and Pensacola, Fla., and of fort on Ship Island, Miss.

In charge of the improvement of the harbors at Pensacola and Cedar Keys, Fla., and Mobile, Ala.

In charge of the improvement of the rivers Chattahoochee, Appalachicola, Suwanee and Withlacoochee, Fla., Flint, Ga., Alabama, Ala., Pascagoula and Noxubee, Miss., Warrior and Tombigbee, in Ala. and Miss., Escambia, Fla. and Ala., Appalachicola and Tampa bays and Pease Creek, Fla., and removal of obstructions in the Choctawhatchee River, Ala. and Fla.

In charge of the examination and survey of Tombigbee River, Miss., Dog Island Harbor, harbor of Key West, Crystal River, La Grange Bayou up to Freeport, Manatee River and Crooked River, Fla., outlet of harbor of Ship Island, harbors at Biloxi and Pascagoula and Old Town, Creek, Miss.

CHARLES J. ALLEN, Bvt. Major, Box H, St. Paul, Minn.—In charge of the improvement of the harbors at Duluth and Grand Marais, Minn.

In charge of the improvement of the rivers St. Croix, Chippewa and Minnesota, of the Red River of the North and entrance to Superior Bay; of the Falls of St. Anthony and of the Mississippi River above the Falls of St. Anthony.

In charge of the construction of Meeker's Island lock and dam, of lock and dam at Goose Rapids on Red River of the North, of dam at Lake Winnibigoshish for reservoirs at headwaters of the Mississippi River, and protection of sand banks on the Chippewa River, Wis.

In charge of the examination of the sources of the rivers Mississippi, St. Croix, Chippewa and Wisconsin, with the view of ascertaining the practicability and cost of creating and maintaining reservoirs, etc., and of headwaters of Rock River, Wisconsin and Illinois.

In charge of the examination or survey of Beaver Bay, Minn., for harbor of refuge, and of Grand Portage Bay and Wanswau-goising Bay, Minn., to determine which, if either, should be made a harbor of refuge; headwaters of Cannon River, Minn., with view that same may be added to reservoir system of Upper Mississippi.

CHARLES W. RAYMOND, Whitestone, N. Y.—Commanding Company A, Battalion of Engineers.

L. COOPER OVERMAN, Nashville, Tenn.—On duty under the immediate orders of Major King.

ALEXANDER M. MILLER, Whitestone, N. Y.—Commanding Company B, Battalion of Engineers.

MILTON B. ADAMS, Erie, Pa.—On duty under the immediate orders of Major Wilson.

WM. R. LIVERMORE, San Antonio, Tex.—On detached service; Engineer Officer, Department of Texas.

WILLIAM H. HEUER, 37 Union St., New Orleans, La.—In charge of the construction of Forts Jefferson and Taylor, Fla.

In charge of the improvement of Sabine Pass and Blue Buck Bar, and Sabine River, La. and Tex., and Neches River, Tex.

In charge of surveys through Sabine Lake and River to Orange and through Sabine Lake and Neches River, to Beaumont.

To report upon the depth and width of a channel secured and maintained by Jetties constructed by James B. Eads at the mouth of the Mississippi River.

Engineer 7th and 8th Light-house districts.

WILLIAM S. STANTON, West Point, N. Y.—On detached service; on duty at the Military Academy as instructor of Practical Military Engineering, Military Signaling and Telegraphy, and in command of Company E, Battalion of Engineers.

In charge of extension to cadet barracks, of new water-works and supply line, West Point, N. Y.

THOMAS H. HANDBURY, Little Rock, Ark.—In charge of the improvement of the Arkansas River—removal of snags, etc., Arkansas River between Fort Smith, Ark., and Wichita, Kans., and at Pine Bluff, and of rivers St. Francis, White, L'Anguille, Fourche Le Fève, Saline, and Black, Ark., and Current, Mo. and Ark.

JAMES C. POST, Jacksonville, Fla.—On duty under the immediate orders of Lieutenant Colonel Gillmore.

JAMES F. GREGORY, 24 Honoré Block, Chicago, Ill.—On detached service; Aide-de-Camp on the personal staff of the Lieutenant General of the army with the rank of Lieutenant Colonel; Engineer Officer, Military Division of the Missouri.

HENRY M. ADAMS, Washington, D. C.—In charge of the 4th and 5th divisions, office of the Chief of Engineers.

JAMES MERCUR, 59 Main street, Norfolk, Va.—In charge of the improvement of the harbors at Norfolk, Va., and Beaufort, N. C.

In charge of the improvement of the Blackwater, Nottaway and Archers' Hope rivers, and Pagan Creek, Va.; Neuse, Scuppernong, Pamlico, Yadkin, Trent, Tar, Lillington and Cape Fear rivers, Currituck Sound, Coanjok Bay, North River Bar, Contentnia and Town creeks, N. C.; North Landing River, Va. and N. C.; and Waccamaw, Great Pee Dee, Wateree and Santee rivers, S. C.

In charge of the examination or survey of bar at mouth of Winyah Bay, near Georgetown, S. C., the water connection between Waccamaw and Cape Fear rivers, Oregon Inlet, and Whiteoak, Meherrin and New rivers, N. C.

Advisory Engineer to National Board of Health in the establishment of a national quarantine station in Hampton Roads, Va.

Member of Board Advisory to State Harbor commissioners of Norfolk and Portsmouth, Va.

CHAS. E. L. B. DAVIS, Buffalo, N. Y.—On detached service; Engineer 10th Light-house District.

BENJAMIN D. GREENE, P. O. Box 36, Charleston, S. C.—On duty under the immediate orders of Lieutenant Colonel Gillmore.

GEORGE M. WHEELER, P. O. Lock Box 93, Washington, D. C.—On detached service in connection with the International Exhibition of Geography at Venice, Italy.

JAMES B. QUINN, 2828 Washington Ave., St. Louis, Mo. Temporarily Osceola, Ark.—On detached service; in charge, and disbursing officer, of works on the Mississippi River under supervision of "The Mississippi River Commission," created by act of Congress, approved June 28, 1879.

DANIEL W. LOCKWOOD, P. O. Drawer 432, New Orleards, La.—On duty under the immediate orders of Major Stickney.

ERNEST H. RUFFNER, Charleston, Kanawha County, W. Va.—In local charge of the improvement of the Great Kanawha River, under the immediate orders of Lieutenant Colonel Craighill.

JOHN C. MALLERY, Whitestone, N. Y.—Commanding Company C, Battalion of Engineers.

CLINTON B. SEARS, West Point, N. Y.—On detached service; on duty at the Military Academy as Assistant Professor of Natural and Experimental Philosophy. In charge of the construction of the new Astronomical Observatory at West Point.

THOMAS TURTLE, 70 Saratoga St., Baltimore, Md.—On duty under the immediate orders of Lieutenant Colonel Craighill.

EDWARD MAGUIRE, P. O. Lock Box 2124, St. Paul, Minn.—In charge of the improvement of the Yellowstone River and of the Missouri River above the mouth of the Yellowstone.

Engineer Officer, Department of Dakota.

FREDERICK A. MAHAN, P. O. Box 70, Pittsburgh, Pa.—On duty under the immediate orders of Maj. Merrill.

CHARLES F. POWELL, Portland, Oregon.—In charge of works of defense at the mouth of the Columbia River.

In charge of the improvement of the harbor at Coos Bay, and entrance to Yaquina Bay, Oregon.

In charge of the construction of the canal around the Cascades of the Columbia River, and of the improvement of the rivers Willamette, Yambill, Columbia, Snake, Skagit, and Cowlitz; mouth of Coquille River, and Lower Clearwater River, Idaho.

In charge of the examination or survey of Columbia River at the Dalles, Young's, Lewis' and Clarke's and Skipanon rivers, near mouth of Columbia River, Ore., Snake River from Lewiston to mouth of Salmon River, Idaho; entrance to Gray's Harbor, between Baker's Bay and Shoalwater Bay, Wash., for canal for light-draught vessels; survey of Chehalis River, Wash.

Engineer 13th Light-house District.

FREDERICK A. HINMAN, P. O. Drawer 42, Milwaukee, Wis.—On duty under the immediate orders of Major Houston.

First Lieutenants.

ALBERT H. PAYSON, San Francisco, Cal.—On duty under the immediate orders of Lieutenant Colonel Stewart and of the Board of Engineers for the Pacific Coast.

JOHN G. D. KNIGHT, 244 Federal street, Boston, Mass.—On leave of absence.

RICHARD L. HOXIE, Columbia Building, Four-and-a-half street, Washington, D. C.—On detached service; Assistant to the Engineer Commissioner of the District of Columbia.

WILLIAM L. MARSHALL, 2828 Washington avenue, St. Louis, Mo. Temporarily, Duncansby, Miss.—On detached service; in charge and disbursing officer of works on the Mississippi River under supervision of the Mississippi River Commission, created by act of Congress, approved June 28, 1879.

JOSEPH H. WILLARD, Whitestone, N. Y.—Adjutant and Treasurer of the Battalion of Engineers and Post of Willets Point and Signal Officer Post of Willets Point. Commanding Company D, Battalion of Engineers.

ERIC BERGLAND, West Point, N. Y.—On detached service; on duty at the military academy as Assistant Professor of Ethics and Law.

PHILIP M. PRICE, Cascade Locks, Wasco County, Ore.—On duty under the immediate orders of Captain Powell.

FRANCIS V. GREENE, 1915 G street, N. W., Washington, D. C.—On detached service. Assistant to the Engineer Commissioner of the District of Columbia.

CARL F. PALFREY, Whipple Barracks, Prescott, Ariz.—On detached service; Engineer Officer, Department of Arizona.

WILLIAM H. BIXBY, care of Drexel, Harjes & Co., 31 Boulevard Haussmann, Paris, France.—On special duty in Europe.

HENRY S. TABER, West Point, N. Y.—On detached service; on duty at the military academy as Assistant Instructor of Practical Military Engineering, and with Company E, Battalion of Engineers. Assistant Engineer West Point water supply. Officer in charge of Post schools. Member of Railroad Board at West Point.

WILLIAM T. ROSSELL, Portland, Me. Temporarily Ashville, N. C.—On duty under the immediate orders of Colonel Thom, on leave of absence.

THOMAS N. BAILEY, Fort Leavenworth, Kans.—On detached service; Engineer Officer, Department of the Missouri.

THOMAS W. SYMONS, Vancouver Barracks, Vancouver, Wash.—On detached service; Engineer Officer, Department of the Columbia.

SMITH S. LEACH, 2828 Washington avenue, St. Louis, Mo.—On detached service; Secretary and disbursing

officer of "The Mississippi River Commission," created by act of Congress, approved June 28, 1879.

DAN C. KINGMAN, Omaha, Neb.—On detached service; Engineer Officer, Department of the Platte.

EUGENE GRIFFIN, Whitestone, N. Y.—Q. M. Battalion of Engineers. A.A.Q.M., A.A.C.S. and Recruiting Officer, Post of Willets Point.

WILLARD YOUNG, West Point, N. Y.—On detached service; on duty at the Military Academy as Assistant Professor of Civil and Military Engineering.

WILLIAM M. BLACK, 1125 Girard street, Philadelphia, Pa.—On duty under the immediate orders of Captain Ludlow, Secretary to Commission Advisory to Board of Harbor Commissioners of Philadelphia.

WALTER L. FISK, Jacksonville, Fla.—On duty under the immediate orders of Lieutenant Colonel Gillmore. Under orders to report to Major Mansfield for duty.

SOLOMON W. ROESSLER, West Point, N. Y.—On detached service; on duty at the Military Academy in department of Civil and Military Engineering.

GEORGE McC. DERBY, Army Building, New York City.—On duty under the immediate orders of Colonel Newton.

JAMES L. LUSK, West Point, N. Y.—On detached service; on duty as Adjutant of the Military Academy; commanding officer of band and field music and Recruiting Officer.

FREDERIC V. ABBOT, Whitestone, N. Y.—On duty with Company A, Battalion of Engineers.

THOMAS L. CASEY, Whitestone, N. Y.—On duty with Company B, Battalion of Engineers.

THEODORE A. BINGHAM, Chattanooga, Tenn.—On duty under the immediate orders of Major King.

Second Lieutenants.

CURTIS MCD. TOWNSEND, Whitestone, N. Y.—On duty with Company A, Battalion of Engineers.

GUSTAV J. FIEBEGER, Whitestone, N. Y.—On duty with Company B, Battalion of Engineers.

OBERLIN M. CARTER, Whitestone, N. Y.—On duty with Company C, Battalion of Engineers.

GEORGE W. GOETHALS, Whitestone, N. Y.—On duty with Company A, Battalion of Engineers.

JOHN MILLS, Whitestone, N. Y.—On duty with Company B, Battalion of Engineers.

JOHN BIDDLE, Whitestone, N. Y.—On duty with Company C, Battalion of Engineers.

EDWARD O. BROWN, Whitestone, N. Y.—On duty with Company A, Battalion of Engineers.

HARRY F. HODGES, Whitestone, N. Y.—On duty with Company B, Battalion of Engineers.

JAMES G. WARREN, Whitestone, N. Y.—On duty with Company C, Battalion of Engineers.

Officers of the Army Detailed for Service under the Chief of Engineers.

A. F. ROCKWELL, Colonel, U. S. A., Washington, D. C.—In charge, under the Chief of Engineers, of Public Buildings and Grounds in the District of Columbia, with the rank of Colonel.

M. M. MACOMB, Lieut. 4th U. S. Art'y, P. O. Lock Box 93, Washington, D. C.—In charge of Geographical Surveys of the territory west of the 100th meridian.

U. S. Civil Engineers.

S. T. ABERT, 1907 Pennsylvania Avenue, Washington, D. C.—In charge of the improvement of the harbors at Washington and Georgetown, D. C., harbor at Breton Bay, Leonardtown, and at entrance of Saint Jerome Creek, Md.

In charge of the improvement of the rivers Rappahannock, Chickahominy, Mattaponi, Totusky, York, Pamunky, and Staunton, Va., Roanoke and French Broad, N. C., and Dan River, Va., and N. C.; of channel in Potomac River through flats in front of landing at Mount Vernon; of Neabsco, Nomini, and Urbana creeks, Va.

In charge of the examination or survey of Staunton River from Brook Neal to mouth of Pig River, Va., Roanoke River from Weldon, N. C., to Clarksville, Va., Potomac and Anacostia Rivers, in vicinity of Washington, D. C., with reference to improvement of navigation, the establishment of harbor-line and raising of flats, so far as their improvement may be necessary, etc., and of survey of Upper Machodoc and Urbana creeks, Va.

In charge of preliminary investigations respecting location, etc., of proposed free bridge over Potomac River at or near Georgetown, D. C.

M. MEIGS, Keokuk, Iowa.—On duty under immediate orders of Captain Mackenzie.

Retired Officers.

Brigadier-General A. A. HUMPHREYS, Bvt. Major-General, 1432 K St., N. W., Washington, D. C.

Colonel THOMAS J. CRAM, Bvt. Major-General, 304 South 19th St., Philadelphia, Pa.

Colonel GEORGE W. CULLUM, Bvt. Major-General, 261 Fifth avenue, New York City.

Colonel JAMES H. SIMPSON, Bvt. Brigadier-General 2 Monroe Place, St. Paul, Minn.

Lieutenant-Colonel LORENZO SITGREAVES, 1236 F St., Washington, D. C.

Major FREDERICK E. PRIME, Bvt. Colonel, care Dr. Buell, Litchfield, Conn.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

Continued from page 173.

CCCXV.—NEW LISBON, O.

New Lisbon, Ohio, in lat. 40° 50′ N., long. 81° 50′ W., is on the Middle Fork of Little Beaver River, on undulating ground.

Settled in 1802, it was incorporated in 1825.

Water-works were built by the town in 1842, taking the supply from springs, the water from which is conducted half a mile through some wooden and some iron pipe of 4 in. diameter to a reservoir 120 by 250 ft., formed by a stone dam 20 ft. high and 120 ft. long across a ravine. The reservoir holds 2,000,000 gallons, and is 80 ft. above the centre of the town.

Distribution is by 1¼ miles of 10, 6 and 4-in. pipe, partly of cast iron and some of wood, with 21 fire hydrants, 10 gates and 24 taps. Service pipes are of wrought iron.

The population in 1880 was 2,028. The consumption is not given.

The works have cost about $30,000, and the receipts have been about $500. There is no record of expenses in 1881, and the receipts were $85.91.

The works are managed by three trustees, one being elected each year.

C. L. Frost is the Secretary.

CCCXVI.—LOCKHAVEN.

Lockhaven, Pennsylvania, in lat. 41° 16 N., long. 77° 31′ W., is on the west branch of the Susquehanna River.

Settled in 1833, it was incorporated as a city in 1870.

Water-works were built by the town in 1869, after plans of Phaon Jarrett, taking the supply from two mountain streams draining 15 square miles, the water from which is impounded by two dams, making reservoirs which contain 14,580,000 gallons at 183 ft. above the city.

Distribution is by wrought-iron and cement pipe of from 12 to 3-in. diameter. In 1881, lightning struck a horse, followed the service pipe to the main and destroyed 400 ft. of 4-in. pipe. There are 15 miles of pipe, with 60 fire-hydrants, 80 gates and 700 taps. Service pipes are of galvanized iron.

The population in 1880 was 5,846. The daily consumption is not known.

The works have cost $130,000 and the receipts have amounted to $90,000. There is a bonded debt of $70,000 at 6 per cent. interest.

The expenses in 1881 were $1,150, and the revenues $6,500.

The works are managed by a committee of the City Council and a superintendent.

E. A. McGill is the Superintendent.

CCCXVII.—NEW MILFORD, CT.

New Millford, Connecticut, in lat. 41° 34′ N., long. 73° 26′ W., is on the Housatonic River, on a succession of irregular terraces, with abrupt changes from one level to another.

Settled in 1707, it was incorporated as a town in 1712. Water-works were built by a private company in 1874, after plans of W. B. Stilson, taking the supply from a small mountain stream which is impounded by a stone masonry dam, the upper face of which is of brick. A brick filter is built in the reservoir, filled with gravel, sand and charcoal, through which the water passes upward into an open chamber, and thence to a supply pipe of cast iron 6 in. in diameter and 1¼ miles long, to the distributing resevoir which contains 2,000,000 gallons at 250 ft. above the village.

Distribution is by cast-iron pipe of 6 and 4-in. diameter, with some 1-in. branches to outlying houses.

There are 4¼ miles of pipe, with 32 fire hydrants, 22 gates and 185 taps. The fire district contributes $600 per year for hydrants. Service pipes are of galvanized iron.

The population in 1880 was 1,434. The consumption is not stated.

The capital stock of the company is $25,000. The works have cost $30,036.62 and the receipts have been $18,540.04. There is no debt. The expenses in 1881 were $411.35 and the receipts $2,955.50.

C. H. Noble is the Secretary and Treasurer, and H. O. Warner the Superintendent.

CCCXVIII.—JOPLIN.

Joplin, Missouri, in lat. 37° N., long. 94° 30′ W., is in the centre of the mining region of Southwestern Missouri, on uneven ground. Settled in 1871, it was incorporated in 1878.

Water-works were built by a private company in 1881, after plans of P. B. Perkins, taking the supply from Shoal Creek, which flows 3¾ miles south of the town, and rises in the Ozark Mountains 50 miles distant. The water is raised 220 ft. by a pump built by Smith, Vail & Co., into a reservoir holding 1,500,000 gallons, built in embankment and lined with stone laid in cement. It is 82½ ft. above the city.

Distribution is by cast-iron pipe of from 12 to 4 in. diameter, of which 12½ miles are laid, with 60 fire hydrants and 20 gates. The number of taps is not given. There are 5 meters in use. The town pays $5,000 per annum for use of fire hydrants. Service pipes are of wrought iron.

The population in 1880 was 7,038.

The works cost $124,000. The bonded debt is $75,000 at 7 per cent. interest.

L. P. Cunningham is Secretary of the company, and C. J. Lewis the Superintendent.

CCCXIX.—NORWICH, N. Y.

Norwich, New York, in lat. 42° 32′ N.' long. 75° 30′ W., is on the Chenango River at the mouth of Cemasawacta Creek. Two high rolling ridges are separated by the valley of the Chenango, one of them rising to a height of 500 ft.

Settled in 1788, it was incorporated as a village in 1816.

Water-works were built in 1881 by a private company, after plans of P. H. Baermann, C. E., taking the supply from a stream of 4 square miles water-shed, called Hopkins' or Ranford's Brook.

An earth dam 40 ft. high, 10 ft. wide on top, and 323 ft. long, with puddle wall in the centre and cross walls of concrete at the base of the puddle wall, forms a storage reservoir 35 ft. deep, holding 30,000,000 gallons at 180 ft. above the village. The water is drawn from the reservoir by a vertical 24-in. pipe, at the base of which is an arrangement of drain tile designed to filter the water, which is thence conveyed to the village through 8,200 ft. of 12-in. cast-iron pipe. Distribution is by 6¼ miles of cast-iron pipe of 12 to 4-in. diameter, with 14 fire hydrants, 55 gates and 100 taps. The town pays $36 per year for each hydrant. Service pipes are of wrought iron.

The population in 1880 was 5,000. The consumption is not known yet.

The capital stock of the company is $50,000. The works have cost $70,000.

T. De Witt Miller is Secretary, and Cyrus B. Martin Treasurer.

(TO BE CONTINUED.)

ACKNOWLEDGMENTS.—The receipt of statistics, as follows, is acknowledged with thanks: From Cyrus B. Martin, Treasurer, statistics and water rates of the water-works of Norwich, N. Y. From C. E. Fowler, Superintendent, 13th Report of the water-works of Poughkeepsie, N. Y. From E. A. McGill, Superintendent, statistics of the water-works of Lockhaven, Pa. From C. L. Frost, Secretary, statistics and water rates of the water-works of New Lisbon, Ohio. From C. J. Lewis, Superintendent, statistics and water rates of the water-works of Joplin, Missouri. From C. H. Noble, Secretary, statistics and water rates of the water-works of New Milford, Conn. From W. W. C. Sites, Chief Engineer, annual report of Board of Public Works of Jersey City, N. J., for 1881.

CORRECTIONS.—May 27, 1882, p. 172.—*Attleborough*, 9th line, for *drought*, read *draught*; 10th line, for *for service*, read *for fire service*.

A COSTLY BUILDING SINKING.

St. Isaac's, the great cathedral at St. Petersburg, which was finished in 1859 and cost $25,000,000, is slowly sinking into the ground and the authorities do not know how to stop it. The Russian capital is built upon a marsh, and the site of St. Isaac's is on one of its softest parts. Over $1,000,000 was spent in driving piles originally, but the building has never been firm and now threatens to topple over at one corner. A recent examination showed that on one side the columns had separated from the architrave, leaving a space of three inches between. The roof was at once lightened by removing large stones, but new fissures appeared as the work went on, the workmen left in fear and the engineers gave up the job as a bad one. Since then nothing has been done except to hold consultations and reject unpractical plans for saving the building.—*Exchange.*

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

JULIUS W. ADAMS,* *Past President A. S. C. E.,* | ASSOCIATE EDITORS.

S. D. V. BURR..... |

SATURDAY, JUNE 3, 1882.

EDITORIAL ANNOUNCEMENTS.

***Communications** for Mr. Adams should be addressed to Julius W. Adams, care of this journal, New York city. Articles written by Mr. Adams will be signed thus *; and only for articles so signed will he be responsible.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

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WE learn from a reliable source that the German government intends to attach architects and engineers of experience to their foreign embassies and legations, to report on new inventions, remarkable achievements, etc., that may come under their notice. An international interchange of thought and experience would be beneficial to all classes.

THE INDUSTRIAL OUTLOOK.

The magnitude of the movement among the workmen to secure higher rates of compensation on declining markets is attracting the attention of more than those who are directly concerned in the exchange of services for wages.

The labor agitations have assumed somewhat alarming proportions, but, after all, the problem involved contains within itself the germs of its own satisfactory solution. That permanent injury can be done to the industrial, transportation and commercial interests of the nation through strikes for higher wages, is, in the long run, practically impossible, as has been repeatedly demonstrated to the terrible cost of the weaker element in such contests. At the present time the iron and steel workers, to the number of fifty thousand, according to estimates made, are in an attitude of rebellion, not against employers but against the laws of trade and forces which control prices and values. It is barely probable that the demands made for an advance of $2.50 per ton in wages, on the present cost of making a ton of iron, at a time when the value of iron has declined from $5 to $8 per ton, will be complied with. Concession may become the least of two evils, as has been seen in iron workers' disputes in years past. Even if so, this fact would obstruct the steady march of values to a lower permanent level, as has been heretofore hinted. The present struggle is entered upon with harmony between all Western manufacturers. They have refused to sign scales submitted to them. The impression exists that one side or the other will give way in a short time. If one, two or three hundred puddling furnaces were thrown idle the restricted production would be beneficial rather than otherwise, but in the present case the number is so great that a scarcity of iron must follow, with a corresponding enhancement of value and price. Demand has declined steadily. A revival of demand would force resumption on the most favorable terms. The labor union whose authority is so widespread in the mills refuses to entertain any suggestion but unconditional surrender. It is not at all surprising that two hundred and fifty million dollars' worth of capital is anxious to escape from the dictation of a power which issues its secret mandates with an iron will, and so resolutely maintains them to the end.

Compensatory influences are at work. Invention is seeking to substitute machinery in iron-making more generally. In time, no doubt, the present tedious and costly methods of iron-making will give place to methods for making steel direct. Much encouraging progress is to be recorded. At present but little economic advantage has been attained; but the possibilities exist for reaping substantial advantages. Increased demand will keep pace with cheapness, and thus affect equal employment at improving rates of compensation, without, as at present, invading the limits of legitimate profits of manufacturers.

One advantage following the declining prices is the increase of requirements. The upward tendency of the past few months, combined with other influences, such as diminished agricultural wealth, decreased volume of available capital, and the like, have checked demand and enterprise and investment. Within a few weeks the tendency to lower prices has brought out many buyers, especially for work required in engineering enterprises. Bridge building is being more vigorously prosecuted. The structural mills have an abundance of orders from the bridge works, and manufacturers report a constant accession of orders for fall delivery. Plate and tank iron are somewhat less active, but there is no scarcity of work anywhere. Locomotive building has not received any set back. Car work is abundant; quite a number of works are making extra time. The demands of the ship and boat yards continue heavy; the foundries and machine shops are crowded with work for the summer. Gas and pipe establishments and works making water-pipe are full of orders. Machinery of all kinds is in extraordinary demand, so much so that for the first four months of the year $265,000 worth of steam machinery was imported because of the inability of domestic concerns to meet requirements promptly. The productive energy of the nation is rapidly gaining ground, and new markets are being sought for our prospective surplus of manufactured products.

The fan-like tail of our industrial prosperity is even now spreading out when one or two of the main branches are suffering. The decline in railway material has not yet had the desired effect of attracting railway builders to the mills because of the lack of other necessary elements. Abundant crops are promised, and this is the chief want. Abundant capital awaits invitation, but the great reserve accumulated by the inactivity of the panic period has been invested and investors are now awaiting returns. Governments are not heavy borrowers, as a few years ago. Hence other channels are sought for. Rates of interest are declining because of the accumulating surplus. The present caution among investors will continue until industrial activity will have sufficiently expanded and the competitive forces have sufficiently reduced prices to afford the needed inducements to plunge into vast industrial and commercial enterprises, some of which are now looming up before the world.

PERSONAL.

A. J. TWIGGS is Chief Engineer of the Augusta & Knoxville Railroad.

C. J. HARDAWAY has been appointed Division Engineer of the Rushford branch of the Tonawanda Valley & Cuba Railway.

G. W. HUGHES has been re-elected Chief Engineer of the Little Rock, Mississippi River & Texas Railroad.

A. M. BANNISTER, C. E., is now engaged on the Guatemala Central Railroad, which will soon be finished to Guatemala.

W. E. TISDALE has been appointed acting Chief Engineer of the Manitoba Southwestern Railway in place of Mr. DAVIDSON, resigned.

DUNCAN MCINTYRE, President of the Atlantic & Northwestern Railway, has left for England, for the purpose of promoting the new railway bridge at Lachine for the Canada Pacific Railway.

THOMAS C. COX.—From a Washington paper of May 26 we take the following:

"Mr. Thomas C. Cox, water registrar of the District of Columbia, died at his residence on N street, West Washington, this morning about ten o'clock, after an illness of some months. He was in the 54th year of his age. Mr. Cox was affected with disease both of the heart and lungs, and the complications were such that it has been thought for some time past that he could not survive. The deceased was a native of Georgetown, being the son of John Cox, who was mayor of that city for many succeeding terms of office. He was Disbursing Clerk in the State department for many years, and while there was sent to England by Secretary Seward on important business connected with that department. He was afterward Secretary to the British-American commission, generally known as 'the High Joint Commission,' which met in this city and he went to Europe with the commission. He was appointed to his present position upon the death of his predecessor, Water Registrar Lubey, a few years ago. Mr. Cox was highly esteemed by his many friends. He was a member of Christ P. E. church, having been confirmed during the rectorship of Rev. W. W. Williams. He leaves a widow and a large family of children. He has a sister, Mrs. Watkins Addison, and a brother, Mr. Richard Cox, living in West Washington. The District Commissioners to-day adopted appropriate resolutions of regret and condolence."

RECENT INVENTIONS.

HEATING RAILROAD TRAINS BY HOT WATER.

This improved device for heating railroad trains by hot water consists of a continuous circuit pipe extending from the fire-box of the locomotive by flexible connections throughout the train, and returning by a separate pipe through the fire-box. The water within the pipes is heated in passing through the fire-box. The pipes through the passenger cars are provided with a series of return bends, each extending under a seat. Back pressure in the water-pipe from the heater toward the tank is prevented by suitable valves. The portions of the pipes which are outside the car are suitably protected.

NOVEL POCKET PHOTOGRAPHING APPARATUS.

A late important invention, which is designed especially for field use, consists of a tripod-head and double plate-holder adapted to be used with what is known as the Walker apparatus. The tripod-head is adapted to be detached from the camera and folded up in very small compass. The double plate-holder, being made of hard rubber, is jointless, and consequently unaffected by moisture. It is by reason of this important invention that it is possible to reduce the dimensions of the camera to pocket size, and also by means of commercially prepared gelatine dry plates for taking instantaneous views. Civil engineers, provided with such an apparatus as this, could obtain important views concerning the topography of the country through which they were projecting railroads, as, by the use of this dry process, it is asserted that no previous experience is required, and that amateurs can secure good results. The complete apparatus is adapted to be stowed away like a field-glass in a pocket slung by a strap over the shoulder. Similar apparatus, as regards size, has been sold before; but I believe no apparatus has

been manufactured having regard for such perfection of detail as that made by the Walker Company, of Rochester.

DESULPHURIZING FURNACE.

A late and new process for desulphurizing ores consists of the following successive steps: First, drying the ores; second, subjecting the dried ore in a close chamber to thorough agitation; third, subjecting the ore to the action of heat; and, fourth, injecting hot air, which has been dehydrated or deprived of its moisture. The air, before being admitted to the roasting-chamber, is dehydrated by being forced through a body of common salt.

SIGNALING BY ELECTRICITY.

This electric signaling apparatus consists of a relay, having a movable armature and retractor, and a device for alternately breaking and closing the circuit thereof, combined with a local battery and circuit, for operating registering apparatus, the terminals of which are controlled by the said relay armature, whereby the condition of the local circuit is changed, both at the movement of the relay armature from and to its movements toward the poles of its magnets. A record is thus made both at the opening and closure of the main or relay circuit.

IMPROVED PIPE-JOINT COUPLING.

A late improvement consists of a pipe-joint for coupling pipes at any angle with each other. The coupling proper consists of two hemispherical shells fitting each other, with an annular overlap joint. Each half shell has a pipe opening suitably screw-threaded to receive the adjacent ends of the pipes. In order to keep the hemispherical shells in place, and steam or water tight, a central bolt is provided, passing through the shells. When it is desired to set the pipe-joint at a certain angle this bolt is loosened and the shells adjusted, after which the threaded bolt is again tightened.

A NOVEL LIMB REST FOR RAILWAY TRAVELERS.

This ingenious device has cords attached to the front edge of the seats underneath and running lengthwise of the same. Across the space in front of each seat is a canvas portion about 18 in. wide, adapted to run over the stretched cords. When not in use or unoccupied the canvas can be slid along upon the cords and compressed into a compact condition at one end of two adjoining seats.

AUTOMATIC RAILWAY SIGNAL.

In this improved automatic railway signal the bell-striking train of wheels is set for action by a passing train, and its controlling detent is released through an electro-magnet which is vitalized by a magneto-generator actuated by the passing train.

IMPROVED LEVEE.

This improvement, coming as it does during the wide-spread devastation in the South from the overflow of the Mississippi, is of peculiar importance. Within the embankment are two or more parallel fences or walls, each of less height than the adjoining one from the rear toward the water front, the tops of posts of the highest fence having pivoted levers to be raised when desired, to heighten the levee, to prevent a wash or repair a break. All the walls rest on the ground under the levee and are covered by it.

PROCESS OF MANUFACTURING WATER-GAS.

This improvement in the process of making the gas known as "water-gas," consists in introducing steam together with air at the bottom of a cupola or furnace containing carbonaceous fuel, for the purpose of raising it to incandescence, desulphurizing it, and preventing the formation of clinker, and disintegrating it if formed; and in introducing steam into the generator at or near the top thereof, and causing it to pass in a downward direction through the incandescent carbon.

IMPROVED AUTOMATIC FIRE-EXTINGUISHER.

This fire-extinguisher comprises the following novel elements: The pipe leading from the reservoir has a valve-seat at its outer end, and a distributor secured by fusible solder around the discharge opening. A valve is employed, the stem of which is secured to the distributor, and the body of which is made in part of a fusible material. The fusible material is fusible at low temperatures, so that in the event of a fire in a building in which the extinguisher is located, a fusion of the parts which retain the flow of the fire-annihilating gas ensues.

IMPROVED SNOW-LOADER AND DUMPER.

This improved snow-loader and dumper for use on railroads consists of a car which is provided at one end with an inclosing shield and at the other with a plow and cutters. Pivoted platforms are adapted to be raised and lowered by means of chains secured to cross-beams of the platform, and passing through rigid brace pieces. A breaker, consisting of beams hinged to the shield and joined at their forward end by a knife, is arranged to be raised and lowered to separate the mass from the drift.

APPARATUS FOR UTILIZING SOLAR HEAT.

In this improved apparatus for concentrating and applying the heat rays of the sun consists of a mirror straight in longitudinal direction, and of parabolic or equivalent curve in cross section, adapted to concentrate the heat of the sun's rays on a focal line. A heat receiver mounted on the axis of the mirror is adapted to be used in combination with this mirror.

WASHINGTON, D. C. F. B. BROCK.

IMPROVED APPLIANCES FOR WORKING UNDER WATER OR IN IRRESPIRABLE GASES.*

History of Diving.—In bringing before the members of this institution the following paper, the author does not intend describing at any length the early history of diving.†

From the earliest times divers have been employed in fishing for pearls, corals and sponges, and have been accustomed, before descending, to place a piece of sponge soaked in oil between the teeth. This is said to have enabled some of the most hardy to remain at least six minutes under water. The records of the earlier attempts to provide some artificial supply of air to divers under water are unsatisfactory. Roger Bacon (A. D. 1240) was supposed to have originated a machine for working under water. The invention of the diving bell is generally assigned to the sixteenth century. The first account of its use in Europe is that of Tasnier, who relates that in 1538, at Toledo, in Spain, he saw two Greeks, in the presence of Charles V., let themselves down under water in a large inverted kettle without being wet. Lord Bacon, in his *Novum Organum* (A. D. 1600) describes the primitive method adopted in his time, in which there was no mode of replenishing the air in the inverted vessel or bell whilst under water. In 1632 Richard Norwood took out a patent for a special means to dive into the sea. Borelli, in 1669, constructed a copper vessel 2 ft. in diameter, with glass fixed before the face of the diver; this he termed a "Vesica." It was worn as a helmet, and securely attached to a dress of goat-skin. Within the "Vesica" were pipes, by means of which a circulation of air was contrived. An air pump was affixed to his side, by which the diver was said to condense or rarify the air within the "Vesica," so as to make himself heavier or lighter, on the same principle as the air-bladder of fishes. Artificial webbing was also supplied to the feet, to enable him to tread water. In the latter part of the seventeenth century the diving bell came largely into use. About 1680 a mania arose for undertaking submarine exploration, and companies were formed for that purpose; but from imperfect appliances they were unable to reap profitable results. About the year 1700 Dr. Edmund Halley devoted much time to subaqueous experiments, and in 1716 he read a paper before the Royal Society entitled "The Art of Living Under Water." In this paper he says: "When there has been occasion to continue long at the bottom of the sea some have contrived double flexible pipes to circulate air down into a cavity, inclosing the diver with armor, to bear off the pressure of water and give leave to his breast to dilate upon inspiration, the fresh air being forced down one of the pipes with bellows, or otherwise, and returning by the other of them, not unlike an artery or vein. This has been found sufficient for small depths, 12 or 15 ft., but when the depth surpasses three fathoms experience teaches us that this method becomes impracticable, for though the pipes and rest of the apparatus may be contrived to perform their office duly, yet the water, its weight now become considerable, does so closely clasp the limbs that are bare, or covered with flexible covering, that it obstructs the circulation." To remedy these inconveniences he turned his attention to the diving bell. His contrivance consisted of a truncated cone of wood, 3 ft. diameter at the top and 5 ft. at the bottom, and containing 60 cu. ft. In the top was placed a strong glass to give light, and a cock to let out air. The bell was coated with lead and weighted, that it might sink steadily; when below it was supplied with air by two barrels of 36 gallons each, which were alternately lowered and raised. He states that he remained one hour and thirty minutes under water, at a depth of 10 fathoms. In 1721 he described to the Royal Society a method by which the diver could leave the bell. He used pipes, 40 ft. in length, made with spiral brass wire inside; one end was fixed in the bell, and the other to a cock which opened into the diver's cap. This was made of lead, weighing 56 lbs., and he also wore a girdle of the same weight, and clogs of lead weighing 12 lbs. each. About the same date, 1716, when Dr. Halley read his first paper to the Royal Society, John Lethbridge invented an air reservoir, made of wainscot, perfectly round, and 6 ft. long, 2 ft. 6 in. in diameter at the head, and 1 ft. 6 in. at the foot. He compressed air into this with a pair of bellows, and then lowered it with himself under water, where he remained thirty-four minutes. Numerous inventors followed in his track. Smeaton, in 1779, first employed the diving bell for civil engineering operations, in repairing the bridge at Hexham, Northumberland. The apparatus was an oblong wooden box, 4 ft. high, 2 ft. wide, and 3 ft. 6 in. long. It was supplied with air by a pump fixed on the surface. Soon after the construction of the New Dock at Ramsgate, in 1784, Smeaton employed an improved diving bell weighing half-a-ton; two men worked in it, and were provided with a constant supply of fresh air through flexible pipes, by means of a force pump placed in a lighter which floated over them. Smeaton appears to be the first person who used the air-pump to force a supply of fresh air to the divers, in the bell under water. A diving dress was invented in 1798 by Kleingert, of Breslau, which consisted of strong tin-plate armor, in the form of a cylinder encasing the diver's head and body, with a leather jacket and strong leather drawers. These were made water-proof, and joined by brass hoops around the metal armor, so that the diver was relieved from the pressure of the water except on the legs and arms. He inhaled the air from the surface through one pipe, and the vitiated air was carried to the surface by another. A diver could not with this apparatus descend to greater depth than 20 feet. About the same date Messrs. John and William Braithwaite constructed a diving apparatus with which they carried out several successful operations. In 1805 they recovered £75,000 in dollars from the East Indiaman Earl of Abergavenny. Rennie, while occupied on the works of Ramsgate Harbor, 1813, made considerable improvements in the diving bell; he designed and constructed a diving bell of cast-iron, 6 ft. high, 4 ft. 6 in. wide, and 6 ft. long, with one side a little heavier than the other, so that it should not float quite level, and thus more readily allow the vitiated air to escape. At the top of the bell six thick bull's-eyes of glass were fixed to admit light. In the center of the top was a circular hole, in which a brass lining was firmly fixed. To the under side of this was attached an air valve on a brass grating. The valve itself was simply a disk of strong leather. A nozzle was fixed to the top of the bell above the valve, and to this was screwed a water-tight leather hose 2½ in. diameter, connected to the air-pump, which was constantly worked by a sufficient number of men. Inside the top of the bell were strong lugs, to which were attached chains for suspending stones or other material. The bell was fitted with seats and a rail for hanging the various tools used by the men; it was slung by stout chains from a double purchase crab fixed on a truck, which could travel along the gantry; the total weight was five tons. Rennie used this diving bell with great success in the numerous harbor and other works with which he was associated.

The Open Diving Dress.—In the year 1828 or 1829, the late Mr. Augustus Siebe, A. I. C. E., the founder of the author's firm, was applied to by Messrs. Deane to assist them in the construction of a diving dress, afterwards known as the Open-Helmet Diving Dress. The helmet was made of copper with a screw lens in front, and a metal elbow riveted on the back of the head-piece, to connect the air-pipe with the pumps, the head-piece and breast-plate being in one. To the breast-plate was attached a canvas jacket, which, with the aid of two lead weights, kept the helmet fixed upon the shoulders. Boots with lead soles, weighing 12 pounds each, were worn, and also a water-proof dress fastened round the neck, over which were placed the helmet and jacket. The air escaped into the water from underneath the outer canvas jacket, and the water reached within a few inches of the diver's mouth, so that he had to work in a vertical position. The air-pumps had

* Paper by W. A. Gorman, read before the Institution of Mechanical Engineers, London, April 20, 1882.

† Those who take an interest in the subject are referred to Lord Bacon's *Novum Organum*; *Philosophical Transactions*, from the time of Halley, 1678; *The History of Inventions*, by Beckman; Boyle's *Experimental Philosophy*; the article on *Diving* in *The Encyclopædia Britannica*; and Messrs. Siebe & Gorman's book on *Diving*.

three cylinders, 3-in. diameter, 9-in. stroke. Even at the present day many of the coast divers use this form of dress.

The Close Diving Dress.—About 1839, when engaged at the wreck of the Royal George, Mr. Siebe, observing the danger attending the use of the open helmet, introduced his invention of the close helmet, fitted with inlet and outlet valves, and with segmental neck screw, to remove the head-piece by one-eighth of a turn. The waterproof dress was fastened to the metal collar by screws and brass bands. Colonel Pasley, R. E., (afterwards Major-General Sir C. Pasley), at once ordered the Royal Engineer divers to be equipped with this dress and helmet, and the operations at the wreck, owing to this great improvement, were carried on with much greater rapidity and without accident.

The above brief description of diving apparatus in its primitive form will be sufficient to show the progress made up to a recent date.

Modern Apparatus.—This apparatus is a very perfect one, combining a high degree of safety with comfort for the diver. The air-pump is capable of compressing air to a pressure of 240 lbs. per square inch, and consists of two vertical double-action gun-metal cylinders, securely fixed to a bed-plate of gun-metal, which is bolted on the base of two side standards forming an iron framing to carry the crank-shaft. Each piston is constructed of two inverted cups of leather, with leather packing placed between, and the whole is secured by two cast-iron piston-plates fitted to the piston-rod inside the leather cups, and pressed together by a nut. Grooves are formed in the periphery of the piston-plates, to contain expanding springs, which, pressing against the inner side of the leather cups, keep them in close contact with the cylinders, and thus maintain the piston in a perfectly air-tight condition. Each cylinder cover has an oil tap for lubrication. The piston-rods pass through glands packed with turned leather washers, and are extended so as to work in guides. Double connecting slings, with gun-metal bearings, connect the piston-rods to the crank-pinks. Inlet and outlet valves are fixed in the covers of each cylinder, and also in the base plate. Spindle valves are used, faced with leather, and with gun-metal seatings, to which the valve is kept by a spiral spring. The top and bottom outlet valves are connected by passages cast on the cylinders, and leading to the air-delivery nozzle. The cylinders are surrounded by a copper cooling cistern.

Pressure gauges show the depth and pressure at which the diver is working, and are also used for testing the air pipes. Each gauge is marked off to represent the pressure in pounds per square inch at given depths of water, as given by the following table:

Depth. Feet.	Pressure. Lb. per sq. in.	Depth. Feet.	Pressure. Lb. per sq. in.
20	8.68	120	52.08
30	13.02	103	56.42
40	17.36	140*	60.76
50	21.73	150	65.10
60	26.04	160	69.44
70	30.38	170	73.78
80	34.72	180	78.12
90	39.06	190	82.46
100	43.40	204†	88.54
110	47.74	....	.....

* Practical limit of diving.
† The last figure is the greatest depth to which (to the author's knowledge) a diver has ever descended.

The fly-wheel and winch-handles, fitted on the crank-axle, are made to be easily removed, and the whole pump is securely fitted in a strong teak case. The author then described the air-distributing arrangement, by which the air can be transmitted to one or two divers as occasion may require. The water-proof dress is made of strong tanned twill, with an india-rubber lining between the thicknesses of the material. It has mineralized india-rubber collars and cuffs. The boots have lead soles weighing 14 lbs. each At the front and back are lead weights 40 lbs. each. An air-pipe with spiral wire embedded in it, and joints fitted to connect up to any desired lengths; a knife, in watertight case, a leather belt and pipe holder, and a double suit of flannels, complete the equipment. For deep water the men wear a body guard to keep off the pressure.

Experience in Working.—Some special cases of diving with this apparatus may be mentioned. In the recovery off treasure from the Hamilla Mitchell, sunk off Shanghai, in a depth of 144 ft., the diver, Robert Ridyard, worked for five consecutive days, five to six hours each day, recovering £40,000 in dollars. The apparatus was used constantly day and night at the raising of the Eurydice. On an average eight divers were working together in a strong tide and amongst wreckage, but not a single accident occurred. When the news reached England that H. M. S. Doterel was blown up, the Admiralty at once telegraphed to the ships of war on the station to proceed to the scene of the disaster, as each of H. M. ships carries a seaman diver and also an artificer diver. H. M. S. Garnet was the first vessel to arrive at Sandy Point. Lieutenant Stanley Dean Pitt, R. N., volunteered to accompany George Hunt, artificer diver, in making a careful survey of the wreck, which was lying in 12 fathoms of water, the result being positive proof that the boilers had not caused the explosion, as they were found in perfect condition. The author considers that the apparatus he has described was in this particular case of great service in the engineering world, to say nothing of the importance to the country, as the whole of the armament and other valuable property were recovered. For engineering works the apparatus is in use at the present time to a considerable extent, as at Colombo, Port Elizabeth, Madras, and many other harbors. The average number of hours for a diver to work in water, say to 60 ft. depth, is four. Their pay depends upon their capabilities; but in this country the average rate is £4 10s. per week for masons, £4 for carpenters, and £3 10s. for laborers. In wrecking operations the divers work at a salvage scale, according to the depth, and as a rule earn very good wages. As so many various handicrafts are required for submarine works, the author's firm have erected a diving tank in their works, where men are trained, and also experiments carried out. The selection of divers requires much care. Steady habits are essential, and from long experience it is found that men of sanguineous temperament are unfit to bear great pressure, while a man slightly built but muscular, although he may seemingly be weak in lungs, often turns out a first-class diver, and improves in health and strength. Among the many purposes for which the diver is required may be mentioned the following: The repairs and inspection of dock gates, sluices, bridge foundations, etc.; the removing of pumps and other appliances in shafts; the repair of well pumps when under water; the cleaning of iron ships' bottoms, and repairing of leaks; the examining or repairing of fouled or damaged screws, etc.; the sinking of cylinders for piers and bridges; the laying of pipes for gas and water in rivers or harbors; torpedo service; and lastly, fishing for sponge, pearl, coral and amber.

Appliances for Working in Irrespirable Gases.—The Fleuss apparatus represents a great improvement in this direction. It is self-contained and entirely independent of any communication with the outer atmosphere, thus enabling the wearer to breathe with safety in the most noxious gases, to walk any distance, and to explore the most intricate turnings of a mine with perfect freedom of action. The principle of the apparatus is that the wearer breaths same air over and over again, the carbonic acid being absorbed from it after each expiration, and at the same time the requisite amount of oxygen restored; thus rendering it pure, and fit to be again inhaled into the lungs. The apparatus consists of a strong copper cylinder 6½ in. diameter, and 12 in. long, with domed ends, and capable of containing 4 cubic ft. of oxygen, at 16 atmospheres' pressure; this being sufficient for four hours' respiration. Above the cylinder is attached a square metal box, 12 in. by 12 in. by 4 in.; this contains the carbonic acid filter, which is a box of vulcanite divided into four compartments by vertical diaphragms, in such a manner that the exhaled breath of the wearer is made to pass twice up and down through the vessel, before it is in a position to be again inhaled. This box is fitted with small cubes of india-rubber sponge, saturated with a thick pasty solution of caustic soda. The exhaled air, being finely divided as it passes through the interstices of the sponge, and coming in contact with a very extended surface of caustic alkali, becomes thoroughly cleansed of all the objectionable products of respiration. A flat bag of vulcanized india-rubber, 12 in. by 15 in., is strapped on in front of the wearer, into this the exhaled air passes from the filter, by means of a tube of india-rubber. The bag is also in communication with the oxygen chamber, and the supply of oxygen to the bag is regulated by a jamb screw-valve, under the control of the wearer. The mask is made to fit air-tight to the face of the wearer, and is held in place by straps buckled at the back of the head. A band of rubber is made to cover the ears, and the eyes are protected by glass when it is necessary to go into smoke or gases that would hurt them. The mask is provided with a pair of flexible tubes with valves, the one for exhaling being in communication with the filter and the one for inhaling being connected to the air-bag. The slightest effort of inspiration brings the revivified air freely to the lungs of the wearer. The whole apparatus weighs 26 pounds and can be adjusted in two minutes. The author considers this apparatus particularly adapted for the use of coal mines, or when men have to deal with noxious gases. Mr. Fleuss has remained in the densest smoke, as also in a glass chamber charged with carbonic acid, for a considerable time. His apparatus was regularly used for some time at the Westminster Aquarium, and also more recently at the re-opening of the Maudlin seam of the Seaham colliery after the fatal explosion in September, 1880. The author has to thank Mr. Fleuss for his kind permission to bring his improvements before the notice of the Institution. In conclusion, the author may allude to the use of the electric light for submarine purposes. It is really the only light which can be of use to the diver, and of late the author has made some very satisfactory trials of it. The telephone has not been fully tested in practice, the divers preferring their ordinary signal line, or communicating by a slate. The author added that since the paper was written ten lives had been saved at the Killingworth Colliery by means of the apparatus. The appliance was also used at the opening of the Maudlin seam of the Seaham Colliery.

NEW YORK WATER RATES.

We have just received one of the most extraordinary circulars that has ever reached our office, and one which illustrates better than any other document we have ever seen the absurdity and inconsistency of the present method, so widely adopted in all American cities, of charging and collecting tariff for the use of water. The pamphlet in question is issued by Mr. Hubert O. Thompson, Commissioner of Public Works, and is entitled "Regulations Establishing a Scale of Water Rents for the City of New York." This city is in a most peculiar condition. Served entirely by one large and expensive aqueduct, wastage has increased so rapidly that long before the time expected the city has been taking all the water the aqueduct is capable of bringing. Consumption, if we may dignify the wicked waste by such a name, is so near the capacity of the aqueduct, and the storage supply in the city so small, that it is exceedingly difficult to find sufficient time during the year to make those repairs which are absolutely necessary.

In spite of the cry which went up a few years ago about the waste caused by factories, steam boilers and the hydrants upon the wharves, it has been found, since that waste was partly decreased by the application of meters, that the general waste still goes on, and that the consumption has not diminished practically. Experience has proved that, contrary to the opinion of former commissioners, private houses and places where meters are not put are the great wasters. Few people familiar with the habits in New York houses will be willing to say that in this class of water users wasting is not the rule rather than the exception. In the lower parts of the city, where hopper closets are employed, we should judge, from our own experience, that 90 per cent. of them run continually. The quantity which they waste can well be imagined when we find that, with a 20-foot head, an ordinary basin cock will pass over 1,500 gallons in 24 hours, and this, too, when running a silent stream. New York's population has been steadily increasing, and the opening and addition of large suburbs to the city has called for a large increase in the distributing mains. Looking at the question from any light we may, it is impossible to see how, even in a large manufacturing population, 100 gallons of water can be used per day for every inhabitant.

We think the Croton Department could easily disprove the theory that manufactories are the great water wasters if they would give us the number of gallons manufactories use and the number of gallons which the aqueduct brings to the city. Threatened as the city has been on so many different occasions with a water famine, the necessity of taking measures to avert it has become imperative, and the regulations to which we have alluded are made evidently with the purpose of accomplishing this. One of the great absurdities of them is found in the fact that they attempt to sell a valuable commodity without measurement. It is as though the butcher or grocer should charge different families according to the number of persons in them, and not by the weight of meat which they order. By the new regulations, bakers, for example, are charged according to the amount of flour which they are supposed to use; private stables are charged according to the number of horses kept in them, and after this charge has been paid the owner is at liberty, by the very nature of the contract, to waste as much water as he chooses, provided he does it in a quiet and private way. Even if it is used legitimately, one man is very likely to require twice as much water as another. If the question is transferred to any other article of use, the absurdity and injustice of such a regulation will be seen at a glance.

The regulations which are laid down are of such a character as to put a premium upon wastage. How great this wastage is can easily be imagined when we begin to figure up in barrels the quantity of water used per day, which amounts to enough to fill three ordinary petroleum casks every twenty-four hours for every man, woman and child in the whole city—a quantity far beyond the actual use of any household in the world. Among the regular rents for water we find that, for a house having a frontage width of 16 ft. and under, the charge, if the house be one story in height, is $4; if two stories, $5; from 16 to 18 ft. in width the rent is $6, and from 18 to 20 ft., $7. This is not

unlike charging a man at a restaurant for his dinner according to the length of his shoe. The man who wears a No. 9 shoe and is 6 ft. high would have to pay 50 cents, while the man who gets into a No. 7 shoe and is only 5 ft. high would have a 35 cent check. While the 16-ft. front pays $5, the 50-ft. front has to pay $15.

After going through a long list of absurd regulations, absurd simply because they take no account of the quantity used, but simply some size, or number or proportion, which is supposed to bear a relation to the quantity, we get to certain regulations applying to private houses. Here the absurdity becomes simply injustice. Any form of hopper "supplied directly from the Croton, through any form of the so-called single or double valves, hopper-valves, stop-cocks, self-closing cocks, or any valve or cock of any description attached to the closet," is charged per year $20. A hopper of the ordinary kind, with its constantly running valve, certainly ought to be charged $20, but where the hoppers are provided with self-closing cocks of approved pattern and well-tested design, which do not leak and cannot be said to run constantly, to charge such a rate is a very great injustice, for we find that any form of hopper or water-closet supplied from the so-called waste-preventive cisterns, "approved by the engineers of the aqueduct," is charged at only $2 per year. The same manipulation which will cause a self-closing cock of the kinds we have alluded to to run continuously, will enable these waste-preventing systems to do the same thing. After discriminating so against the hopper, the pan closet is charged only at $10 per year when supplied in a similar manner. These regulations also discriminate, we had almost said intentionally, against some of the best and most economical forms of cistern closets that are in the market. It is useless for the Commissioner of Public Works to attempt to prevent the waste of Croton water by specifications of any particular forms of water-closet apparatus. It is equally useless and futile for him to charge an outrageous price for water which is to be supplied in a particular form of water-closet which is considered unusually vicious. People will pay the extra charge, but will grumble and waste more water than the charge would cover.

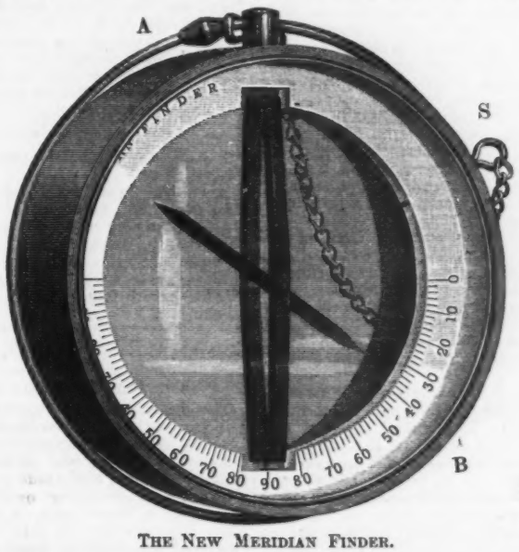
The absurdity of these charges may be seen by stating the case in this way: $20 is the rate charged for water-closets and urinals where the valve is of a character to allow a continual flow of water, and yet this sum is sufficient to pay for a water meter. We only happen to have a single water-meter circular before us. It is that of an approved style, which has been in use for 25 years or more and has been well tested. From it we find that a ⅝-inch meter, or one suitable for a ⅝-inch pipe, will cost $17, or $3 less than the charge per annum. This meter is able to supply water in ordinary private houses, and would do what ought to be done, and enable the charge to be made proportionate to the quantity of water used. We might overlook the absurdity of this method of ascertaining the consumption of water, if it were not for the fact that the Commissioner virtually says that only one style of closet shall be used. Practically, the house-owner finds he can only use the closet approved by the Commissioner, where there are many others equally good, and several decidedly better in every respect.—*The Metal Worker.*

AMERICAN SECURITIES.

I see it is stated in several newspapers that American "Rails" have gone up, owing to purchases by English investors. Nothing can be more contrary to fact. At the present moment the American market is overstocked with securities. The old stocks have been pushed up to a very high level, and those connected with new undertakings are in the hands of syndicates and speculators. In the United States investors are perfectly aware that prices must come down, and therefore they do not buy. In England they have also somewhat tardily arrived at the same conclusion, with a similar result. Purchases, therefore, on both sides of the Atlantic are limited to speculators. They buy because they fancy that the great capitalists will combine in order to cause a general rise of prices, whilst the great capitalists encourage this opinion in order that they may sell the securities with which they are overstocked. The trick of these latter is to offer to buy enormous amounts of a stock at two or three per cent. above the current market price of the day. As they know that the stock could not be delivered, the offer is a perfectly safe one to make. Mr. Gould and Mr. Vanderbilt are now acting together. With their great command of cash they can rule the market. But, as I have said, their object is to sell, so as to get rid of the stocks which they hold at a profit. All telegrams, all devices, and all prices from America, must therefore be distrusted just now. When once the great capitalists have managed to wriggle out of their stocks, they will inaugurate a counter movement, and prices will very likely fall as much below intrinsic value as they are now above it. English investors must never lose sight of the fact that the great American fortunes have been made by their owners playing against the public with cogged dice. For my part, I do not believe—speaking generally—that any investor is wise who buys a single share of an American railroad. Of course he may make money by doing so, but he is entirely in the hands of knaves, who command the railroad, who can regulate rates as it suits them, and who are rather less honest than the professors of the three-card trick on our race-courses, although more wealthy.—*Truth (London).*

THE NEW MERIDIAN FINDER.

The accompanying engraving presents an accurate representation of this new compass, and is so clear as to scarcely need any description. In use it is held by the suspension ring *A*, and the needle released from its fixed position by drawing away the stop *S*, the object of which is to prevent oscillation when the needle is not in use. The released needle will attempt to find its true magnetic meridian, and in doing so, should it come in contact with either of the two glasses used as protection from the weather, it is only necessary to turn the case until the needle revolves freely, without touching either of the glass covers; the needle will then point in the direction of the true magnetic meridian.



THE NEW MERIDIAN FINDER.

The needle has a motion in azimuth as well as in altitude, and is, therefore, sure of finding its own true magnetic meridian. The needle is so suspended that nothing interferes with its making a complete revolution, so that the all important and final test of reversion can be applied to prove its accuracy.

The New Meridian Finder Miners' Compass is manufactured and sold by the patentees, Messrs. W. Gardam & Sons, 96 John street, this city.

HYGIENIC EXHIBITION AT BERLIN.

A general German exhibition is to open at Berlin on the 1st June next, devoted to objects and methods relating to hygiene and life-saving. It has been organized by the two leading German health societies, and especially includes Germany, Austria, and German Switzerland, though other countries are not excluded. The Empress Augusta has conferred her patronage on the undertaking, of which Herr Hobrecht, Minister of State, is president. The guarantee fund amounts to 200,000 marks (£10,000). Exhibits will be classified according to their practical application, and not their origin; they are divided under (A), hygiene, and (B), life-saving, which again are sub-divided into (1), material objects; and (2), the plans, specifications, regulations, statistics, etc., relating to them. In the various groups occur the following: Boring machines; methods for consolidating roads; appliances for cleansing streets; sewers and their dependencies; water supply; public illumination; electric lighting; gas works; markets and slaughter-houses; baths, washhouses and laundries; private dwelling houses; buildings for the residence of a large number of persons and for public assembly, with their lighting, heating and ventilation; factories and laboratories; electric railways; the heating of towns for a central point; drainage of marshes and irrigation; regulations as to buildings; means tending to improve the condition of the working classes; State supervision of factories; methods for diminishing the inflammability of timber; the prevention of floods; protective measures for land transport, and the prevention of accidents by machinery.

BERLIN, May 12.—A fire broke out to-day in the hall of the Hygienic Exhibition, near Moabit, in the district of Potsdam. The building, which was constructed of wood, was soon burned to the ground. The exhibition was to have been opened on Tuesday next, and many costly exhibits were already in place, all of which were destroyed. The flames spread to and swept away several timber yards adjoining. An explosion of gas in a café on the south side of the building caused the fire. The loss is estimated at several hundred thousand pounds. The Emperor William came from Potsdam, and was on the ground during the height of the conflagration. No lives are known to have been lost.

CHECKING THE WASTE OF WATER.

Mr. Greenough, of Ward Nine, from the Committee on Water, made a lengthy report to the council yesterday on the subject of the waste of water and the measures necessary to be taken to prevent the same. At the present rate of consumption, which averages 95 gallons per head each day, the entire capacity of the water-works, including the additional supply to be received from the new basin now being built in Ashland, will be reached in 12 years, while if the rate of consumption could be reduced to 60 gallons per head daily (which amount is regarded as a liberal allowance), the capacity of the water-works would not be reached until the year 1900, and the city would also save $3,000,000 which it will be required to expend to enlarge the system unless the waste is prevented. As showing the amount of water consumed as compared to other cities, the committee cite the following cases:

	Gallons.
Brooklyn	54.2
Cincinnati	75.9
Cleveland	63.6
St. Louis	72.1
Liverpool	27.0
Glasgow	60.0
Providence	36.3
London (average of nine companies)	27.5

The principal reasons for the waste of water are defective mains and services, defective fixtures in buildings, bad plumbing and willful waste. The remedy for the waste was the meter system, house-to-house inspection and the waste-water meter system, and to carry out the conclusions of the committee the passage of the following order was recommended:

Ordered, That the City Treasurer be authorized to borrow, under the direction of the Committee on Finance, the sum of $125,000, the same to constitute a special appropriation for the purchase and attachment of water meters; $100,000 to be expended by the Water Board in purchasing recording meters, and $25,000 to be expended by the City Engineer, under the direction of the Water Board, in purchasing and attaching waste-water meters.—*Boston Journal, May 26.*

CONCERNING MILL DAMS.

Waterloo, Iowa, was several weeks since the scene of a rather interesting trial of a mill dam case, in which the expert testimony called in testified upon the question of how high a dam could be erected below the present structure without backing water up on the tail races of the mills using the present power, and whether a structure designed for a low

stage of water, and not interfering with the present power in times of low water, would interfere in high water.

Prof. Philbrick, of Iowa University, testified in behalf of the owners of the present dam and C. B. Davis, C. E., of the Madison Water-works, and A. D. Conover, professor of civil engineering, Wisconsin University, were called in to advise the new company as to the proper height for their proposed dam, and to testify in defense of their advice before the court.

The trial lasted four days, and the time was consumed chiefly in taking evidence. The judge, after hearing an hour's argument from each attorney, rendered decision without leaving the bench, granting to the new company all the privileges they asked for.

ENGINEERS' SOCIETIES.

ENGINEERS' CLUB OF PHILADELPHIA.

Record of Regular Meeting.—May 20, 1882.—Vice-President Percival Roberts, Jr., in the chair. Twenty-seven members and five visitors present.

Mr. T. M. Cleemann read a paper on the "Most Economical Height of Bridge Truss." He said that in most cases of bridge design, after the span was fixed, the height of the truss was only governed by the judgment of the engineer, who generally assumed a proportion derived from some previously constructed bridge. It is not difficult, however, to find the most economical height, and the method, applied to a Howe bridge, was explained, and the result of a similar application to one of the largest iron bridges heretofore constructed likewise stated.

He also continued some remarks that he had previously made on the strength of wrought-iron columns, especially discussing certain experiments which had been lately made at Watertown, with the formulæ that had been proposed to represent their strength.

The latter paper was discussed at some length by Messrs. H. Constable, Strong, Haupt and P. Roberts, Jr.

Mr. Geo. S. Strong gave an interesting illustrated description of experiment in the application of his Feed-Water Heater to locomotive engines, and also described new devices of his invention, for the piston and connecting rods of locomotives and for a spark-arrester.

Various favorable communications were read from members of Congress in reply to the communication of the club urging the passage of House Bill 4,726.

HOWARD MURPHY,
Secretary and Treasurer.

THE CIVIL ENGINEER.

Well may they sit and banquet, who show the rule of man,
O'er earth and sea, who with the bridge the rolling waters span,
Who tunnel underneath the sea, who climb like mountaineers,
Who drive the great sea-eagles—the gallant Engineers.

They combat Nature's forces, and earth, and sea, and air,
Find men to bend them to their will who labor everywhere;
They bring the lightning from the sky to grace our chandeliers,
And plough the furrows of the sea—the able Engineers.

Then here's a health to Armstrong, and each engineering star,
To Fraser of the Woolwich guns, those mighty babes of war:
They civilize in times of peace, and aid when strife appears,
The Titans of our modern times—our Civil Engineers.

London Punch.

COPYING DRAWINGS.

Tilhet's method of copying drawings in any desired color is thus described in the *Polytechnisches Notizblatt:* The paper on which the copy is to appear is first dipped in a bath consisting of 30 parts of white soap, 30 parts of alum, 40 parts of English glue, 10 parts of albumen, 2 parts of glacial acetic acid, 10 parts of alcohol of 60° and 500 parts of water. It is afterward put into a second bath, which contains 50 parts of burnt umber ground in alcohol, 20 parts of lampblack, 10 parts of English glue and 10 parts of bichromate of potash in 500 parts of water. The papers are now sensitive to light, and must therefore be preserved in the dark. In preparing paper to make the positive print, another bath is made just like the first one, except that lampblack is substituted for the burnt umber. To obtain colored positives, the black is replaced by some red, blue or other pigment.

In making the copy, the drawing to be copied is put in a photographic printing-frame, and the negative paper laid on it, and then exposed in the usual manner. In clear weather an illumination of two minutes will suffice. After the exposure the negative is put in water to develop it, and the drawing will appear in white on a dark ground; in other words, it is a negative or reversed picture. The paper is then dried and a positive made from it by placing it on the glass of a printing-frame, and laying the positive paper upon it and exposing as before. After placing the frame in the sun for two minutes, the positive is taken out and put in water. The black dissolves off without the necessity of moving it back and forth.

THE CORINTH CANAL.

The King and royal family of Greece were present on the 4th at the turning of the first sod of the Corinth Ship Canal, which will considerably shorten the voyage for vessels trading between the West and the Ægean and Black seas. A grand marble column is to be subsequently erected in commemoration of the ceremony. In cutting the first sod, King George used a silver spade, while the Queen fired a train of 47 dynamite mines, which removed some of the rocks projecting on the line of the canal.

OUR BURNT OFFERINGS.

According to statistics collected by the *Insurance Chronicle*, the losses by *reported* fires in the United States in the past six years amount to $430,840,300, and in Canada $56,710,300, the total being equal to the capital invested in our national banking system. It is stated that nine-tenths of this loss could have been prevented by care and precaution.

NOTES.

THE IRON MOUNTAIN OF DURANGO.

The almost fabulous accounts which reached us a short time since of the enormous iron mountain near the city of Durango, Mexico, are, after all, not so very exaggerated as they appeared to be on first impression, for there is a good, solid substratum of truth in them. We have it on the authority of a trustworthy witness, Mr. J. Birkinbine, the secretary of the United Association of Charcoal Ironworkers, who recently made a professional visit to the now celebrated mountain, that it in reality forms a great mineralogical wonder. The Cerro de Mercado, the mountain in question, rises north of Durango, not two miles from its plaza, from the plateau to a height of 600 ft., its length being a mile, its width a third of a mile. Mr. Birkinbine says: "Nothing which I have seen, either in the Lake Superior or Lake Champlain regions, in Alabama or in Missouri, compares with it for magnitude, and even our Pennsylvania Cornwall is small when placed beside it. Several estimates of its cubical contents have been made, all running into hundreds of millions of tons. I have spent three days climbing its steep sides and looking up at its precipitous faces of ore, and feel safe in the assertion that the loose boulders and stones, which everywhere cover the surface, would produce one million tons of pig iron or more. Should the interior of the mountain be composed of as solid ore as the vertical faces, rising like turrets from the slopes made by detritus from them, an estimate of this deposit is beyond our appreciation, for ore was found far below the surface in sinking for an artesian well. There are several problems in the formation which present a surmise to the structure, and here I venture no estimate of the quantity of ore available. It is, however, beyond doubt ample for immense industries, and analyses published of it show remarkable richness and superiority." It is a strange commentary on the absence of metallurgical enterprise in this rich mineral region—gold, silver, mercury, tin and lead being also found in the district—that, under the shadow of this great iron deposit, at Durango, nails should sell at 25 cents per pound, castings at 12½ cents per pound, and a pair of iron-tired cart wheels with iron axle for $125.

THE BASIS OF PROBABILITIES.

Life insurance men know that while nothing is more uncertain than the life of a single individual, the average lives of a thousand men can be calculated with almost absolute certainty. Analogous to this is the regularity of other phenomena, when taken in reference to sufficiently large numbers. While there is, of course, no way of producing such a result, there is born in this city, for example, about an equal number of males and females. If a pack of cards is shuffled at every drawing, and a million of cards are drawn, one after each shuffling, the number of black-spot cards drawn will almost exactly equal the red-spot cards drawn, however often the experiment may be tried. In a city like New York, the number of births each week is nearly equal, and the same is the case as to the deaths, unless there happens to be an epidemic. In the post-office the number of letters delivered each week is so nearly the same as to fill the mind with astonishment. In a great hospital the number of patients each week is nearly the same the year round, and the diseases — such as consumption, pneumonia, typhoid fever, etc.—are very nearly the same from year to year. The number of articles left in cars, omnibuses, and public vehicles, incredible as it may appear, are so near the same number from week to week that the result is simply wonderful. The crimes committed during a year, as the criminal statistics show, are nearly the same in number each year. Accidents happening in the public streets, which would seem to be dependent on no law known to us, reproduce themselves with a like accuracy as to numbers from month to month. Ten weeks' accidents in the streets, taken at random from the official reports of Paris, give the following results: 43, 43, 50, 58, 41, 47, 49, 50, 52, 44. Who can tell the reason of such similarity of events from week to week and from year to year? In the sciences and in the arts when a series of facts are given, it is pretty certain that the causes producing or governing them can be discovered; but such is not the case in regard to the facts such as we have mentioned. The certainty of these results have caused thoughtful men to try and utilize these unknown principles in speculation and gambling. In other words, by studying and following the results of chance which they have spent years in recording. If such efforts have proved successful the result has not been made public. Such facts as we have stated are well worthy of investigation by the learned, as no law has yet been discovered to which they can be referred.

THE EARLY HISTORY OF GAS-LIGHTING.

It has been known for many generations that sometimes coal-seams yield a combustible gas. In the neighborhood of Wigan, England, during the latter part of the seventeenth century, a Dr. Clayton observed gas issuing from the ground, and from the Philosophical Transactions for the year 1677 we learn that Mr. Shirley made some experiments on the production of gas from coal, obtaining what he describes as "black oil" and a "spirit," evidently meaning coal-tar and gas. Much more satisfactory reports of similar experiments are given in the chemical essays of Dr. Watson, published during 1767, by whom, in the report of an experiment on this subject, we are told that from ninety-six ounces of Newcastle coal he obtained twelve ounces of water and gas-tar; twenty-eight ounces of "air" or gas, and of coke fifty-six ounces. A few years later, Earl Dundonald tried experiments in gas-lighting at Culross Abbey. It appears, however, that these experiments on the distillation of coal were made for the production of tar. The Scotchman, William Murdock, is considered the real inventor of gas illuminating. In 1792, he lit his workshop at Redruth, Cornwall; and in 1802, the first attempt on anything like an extensive scale of illumination was established at the manufactory of the renowned Boulton & Watt, Soho, near Birmingham. While this was taking place in England, and probably without any knowledge of it, a Frenchman named Lebon succeeded in lighting a house in Paris with gas. Other works followed the example of Soho, a Manchester cotton-mill being the next, in 1804. In the year 1807, a German named Winson used gas to light Pall Mall, and five years after he originated the first gas company, "The London & Westminster Chartered Gas-Light and Coke Company," while the French did not adopt this method of public lighting until 1820.—*Engineering and Mining Journal.*

THE ENGLISH CHANNEL TUNNEL.

Much fear has been manifested that the tunnel might, after having been completed, serve as a highway for invading forces from France, and to comfort the timid ones Dr. Siemens lately presented to the Military Committee on the subject of the Channel Tunnel a plan of defense against invasion. He proposes to place a tube just above the lateral drainage tunnel, terminating on the tunnel side in a double arch, with numerous perforations into the tunnel, and on the land side in several chambers of wrought iron sunk into the ground. These chambers he proposes to fill with lumps of common chalk and to connect each of them by means of a pipe with a large cistern filled with dilute muriatic acid. Upon opening the communication this acid would flow into the upper portion of one of the chambers, where it would be distributed by perforated pipes over the entire area. The result of such an inflow would be a powerful chemical reaction, giving rise to a generation of carbonic acid gas, which would for half a mile or more form an insuperable barrier in the passage of human beings through the tunnel. The valves by which the acid was turned upon the chalk might be worked from a safe distance by electricity. Dr. Siemens stated that by the adop-

tion of the scheme the tunnel would be left intact and fit for use after a reasonable interval for proper measures to clear it from the carbonic acid gas.

ELECTRIC LIGHT VS. GAS.

The controversy as to the respective cost of gas and the electric light, if it has not been definitely settled, is, we think, on the road towards solution. The figures now vouchsafed to us by the city authorities may, we take it, be relied upon. We learn that at the meeting of the Court of Common Council held last week Mr. Felton, chairman of the Court of Sewers, stated that, of the three electric lighting systems now being tried experimentally in the city, that of the Brush was about the same price as gas, the Lontin was twice the cost, and the Siemens nearly four times the cost. The Brush patentees had, however, given notice to increase their contract price 10 per cent., and the Siemens authorities also contemplated increasing their estimate to five times the cost of gas in the same area. As to the new effective gas lighting in Fleet Street, he might state that it was over four times the cost of the Brush system in the same district. In reading the above business-like statement, we arrive at two conclusions. In the first place, the effective mode of lighting up the city by arc lamps is nearly as cheap as the indifferent illumination produced by gas. In the second place, it is equally certain that, if gas-light is to be as effective in the open air as the electric light, its cost will be at least three times that of, say, the Brush light. It must, however, be admitted that the latter is the best and cheapest arc light we have at present, its superiority and consequent cheapness being principally due to the excellent quality of the carbons used by the company which owns the light.—*Iron*, April 7.

OUR PLAT AND PROFILE BOOK.

THE following from a Waxahachie, Texas, correspondent, with an order for several additional copies, is but one of many similar notes of approval received:

"The Plat and Profile Book, ordered some time since, came safely to hand. It is just the thing needed; convenient in size, form and style."

J. A. G. W., H. & T. C. Ry. Eng. Corps.

SANITARY APPLIANCES IN PARIS.—As now provided for, Paris claims to have the benefit of the best devised system of sanitary appliances to be found in any city in Europe. The scavenging plant, under this new arrangement, is kept in a central depot, where materials of every description are stored and classified for ordinary and extraordinary service. Among these sanitary supplies are chloride of lime, sulphate of zinc, sulphate of iron and carbolic acid as disinfectants, and hydrochloric acid and nitro benzole as cleansing agents. Chloride of lime is used of a strength of one hundred to one hundred and five degrees; sulphate of zinc at a strength of one-eighth; and carbolic acid is used at a strength of one to forty, and down to one per cent and even less. For watering streets and gutters, it is used as weak as one of acid to one thousand of water. Hydrochloric acid is applied to urinals and slaughter-houses at a strength of one-sixth to one-tenth. Nitro-benzole is also employed of the same strength.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in the s columns any items of interest that may be furnished us.*

GAS AND WATER.

WATER-WORKS FOR EASTHAMPTON, MASS.—Engineer Davis has been instructed by the water committee to go on and make estimates for getting water into the village from the Turkey hill brook, so that a special meeting will be called during the summer to act on the matter. It is estimated that the whole cost of the works will be over $150,000.

BIDS FOR WATER-WORKS.—A dispatch from Tyler, Tex., says: "At a meeting of our citizens last night it was decided to leave it open to bids from different companies represented here on the subject of water-works for our city, and it is a decided fact that we will have the benefit of this addition to our now growing city."

THE CURTIS REGULATOR COMPANY of Boston has recently received an order from the Lockwood Company for three sets of their pressure regulators and steam traps for their new mill at Waterville, Maine.

MINNEAPOLIS, MINN., will extend a 16-in. main from the water-works up Third street to tap the Hennepin avenue main, to give that and its connecting mains a better supply of water.

WASTE OF WATER FROM CLOSETS.—A Cincinnati dispatch says: At yesterday's session of the Board of Public Works the Superintendent of Water-works reported that the recent inspections of waste of water have resulted in the discovery of an alarming abuse of water privileges, designedly and carelessly done. They consist mainly of the propping up of water closet handles. A long list is given of parties detected. The flow of water, if constant under average pressure, will be not less than 20,000 gallons per day from a water closet, or equivalent in money to $2.40 per day. The Superintendent recommends that a fine of $5 be imposed upon each person detected in a willful waste of water. The report was adopted.

WATER PRESSURE AND TEMPERATURE OF ARTESIAN WELLS.—At a recent meeting in Chicago of the Academy of Sciences Dr. Andrews gave a description of the academy's examination of the water pressure, temperature, etc., of Judge Caton's artesian well. The temperature at the bottom, 2,000 ft. down, was about the same as at the top, or about 72 degrees. The bottom, in temperature, is only about 22 degrees higher than the air at the surface of the earth. The increase in temperature was only one degree in 98 ft. in depth, while in Europe 20 ft. made the same increase. The water contains 64 grains of salt to the imperial gallon. An adjacent well contained 43 grains of salt to the gallon.

THE Municipal Gas Company, of Brooklyn, N. Y., has increased its capital to $3,000,000.

METERS.—During the month of May the National Meter Company, of this city, sent away seven 10-inch "Gem" meters; three for the city of Buffalo and four for the city of Bayonne, N. J. They also sent fourteen 3-inch "Crown" meters to Boston. A fast accumulation of orders and the bright prospects of the future compelled the company, during the past month, to increase the capacity of the works in all the departments. The foundry has been extended and new furnaces and ovens placed beside those already in position; the floor space of the machine shop has been increased to permit of the addition of new machinery specially designed for the work.

THE HUACHUCA WATER COMPANY have pipes laid to Tombstone, Arizona Territory, and will deliver water in a few days. The source of supply is at the Huachuca Mountains, being the concentration of several streams from the different cañons of the mountains. The cost of the works exceeds $500,000.

ELECTRICITY.

BLASTING BY ELECTRICITY.—Electricity is now employed in firing the charges in blasting stone in the quarries at Huntington, Ind., and it is estimated that a saving of 50 per cent. is effected over the old plan.

A NEW USE FOR ELECTRIC LIGHTS.—Thursday evening, at 10 o'clock, a flock of wild ducks in their flight over this city, were attracted by the brilliant glare of the electric light on the Bank street mast, and several of the birds flew directly against the lamps, shattering three of the glass globes and bringing down three good fat ducks, which were triumphantly carried away by passers-by. The lights that were interfered with went out, but the others burned more brilliantly than before. —*Cleveland Plaindealer.*

DALLAS, Texas, will be lighted with electricity.

TELEPHONE LINE.—The work of constructing the telephone line between Saratoga Springs and Albany will be commenced next Monday. The new line will include Schuylerville in its circuit, and Manager Sturges expects to have it operating to that village inside of a week and to Albany about the middle of June.—*Saratogian.*

STREETS, DRAINAGE, ETC.

THE City Engineer of Minneapolis, Minn., has been authorized to advertise for proposals for the constructing of several culverts.

RAILROADS.

NORFOLK & WESTERN RAILROAD COMPANY.—Monthly statement of earnings and expenses for April, 1882:

Gross earnings	$171,793.32
Expenses	104,980 61
Net earnings	$66,812.17

For four month, January 1st to April 30th:

	1882.	1881.	Inc. or Dec. in 1882.
Gross earnings	$664,793.66	$688,637.87	D. $23,844.21
*Expenses	410,744.39	374,969.15	I. 35,775.24
Net earnings	$254,049.27	$313,668.72	D. $59,619.45

*Expenses include estimated proportion of yearly taxes.

THE COLUMBUS & NORTHWESTERN.—It seems to be a settled fact that the Columbus & Northwestern Railway Company intend to build a branch from Columbus to the coal-fields. The road is intended to make a through coal road to Chicago from the extensive fields below here.

RAILROAD PROGRESS IN TEXAS.—The work of pushing the construction of the Sabine Pass & Texas Northern Railway is progressing.

NORTHERN PACIFIC PLANS.—Henry Villard, President of the Northern Pacific, stated, at a reception tendered him in Philadelphia recently, that the Oregon Transcontinental Company intends to build tributary lines through the territory traversed by the Northern Pacific.

THE SAUK CENTER NORTHERN.—SAUK CENTER, Minn., May 26.—Ground was broken yesterday on the Sauk Center Northern at this point. The contract is let for some distance beyond Long Prairie, and the work will be pushed with all possible speed.

THE D. M. & ST. L.—Orders have been issued to commence track laying on the Des Moines & St. Louis, Wabash road, between Des Moines, Ia., and Albia. There are yet 25 miles of track to lay, and it is expected to complete it and bring trains into Des Moines by July 1.

THE GRAND FORKS & MISSOURI.—Mr. Johnson, the engineer in charge of surveys for the Grand Forks & Missouri Valley Railroad, announces that the necessary help has been secured and the party organized. They expect to start out the first of next week, and will run the first line without taking any levels, their purpose being simply to get an idea of the topography of the country with reference to the engineering difficulties and also the final success of the road after it is built. The objective point for which the party will start is Oriska, 35 miles distant, which will probably be reached within three weeks. The return trip will then be made, and as the final route will by that time have been decided upon, the levels will then be taken.—*Grand Forks Plaindealer.*

NEW RAILWAYS TO BISMARCK.—A dispatch from Bismarck, Dakota, says: "A letter was received tonight by a Bismarck merchant from a prominent railroad official, stating that the Northern road would finish a survey to this point immediately, and it was not improbable that the road would be built this year. The Chicago, Milwaukee & St. Paul was surveyed to within twenty-five miles of Bismarck last fall. The bulk of immigration now being to points west of the Red River Valley to the Missouri slope, coupled with the fact that the enormous quantity of government supplies are annually shipped from here to various northwestern military posts via the river, it would seem that the roads want a slice of the business; besides, both Chicago and Milwaukee are anxious to get some of the Dakota wheat now shipped almost entirely via the Northern Pacific to Duluth and Minneapolis."

VICKSBURG, SHREVEPORT & PACIFIC.—SHREVEPORT, La., May 25.—Dispatches received here state that Major R. H. Greene, Chief Engineer of Rio Grande & Mississippi Railway, now being surveyed, will establish headquarters here instead of at Houston, Tex. This is said to be a continuation of the Vicksburg, Shreveport & Pacific Railway, of the Erlanger combination from here to the Rio Grande River, crossing near Eagle Pass, thence to the Gulf of California. Surveying parties have been out for the past two months, and it is thought establishing headquarters here means the construction will be commenced at this point and pushed through as rapidly as possible. The work on the gap between here and the Mississippi River is progressing rapidly.

RAILWAYS IN MEXICO.—LAREDO, Tex., May 21.—The Mexican National Railway passed Bustamente, Mexico, which has a population of 4,000, on the 29th inst., and reached Villa Aldama, which has also a population of 4,000, last night, and is now 110 miles west of the Rio Grande River. The work has been accepted by the Mexican government. A celebration by citizens of both sides of the river will take place this week, which promises to be on a grand scale. Application has been made to open this section of the road for traffic to Villa Aldama, which will entitle the company to a subsidy of nearly $2,000,000. The Mexicans are enthusiastic over the project. It is expected that the road will reach Monterey in September. The first mile of the Rio Grande & Pecos National line was laid on the 29th inst., and operations on the International extension will begin shortly. This section of the Rio Grande border is unusually peaceable at present.

THE ST. LOUIS & SAN FRANCISCO.—Messrs. Fruin & Swift, contractors for the grading of the St. Louis & San Francisco Railroad track between St. Louis and Kirkwood, have received orders to suspend further operations. By this order 500 men and 150 teams are thrown out of employment. Work has already been done to the amount of $150,000, in addition to the heavy expense of purchasing property for the right of way.

TALKED-OF EXTENSION.—It is given out in railroad circles that the Missouri Pacific Railroad intends extending its double track from Laclede to Kirkwood. Work will continue on the St. Louis & San Francisco track from Kirkwood to Franklin, or Pacific, as it is indifferently called. This arrangement will give the Missouri Pacific a double track from St. Louis to Pacific, and will probably set at rest the negotiations for the purchase of a right of way to Pacific via Crève Cœur Lake, or which is known as the Labadie cut-off.

CHICAGO & ALTON EXTENSION.—CHICAGO, May 24.—Officers of the Gulf, Colorado & Santa Fe Railway Company, operating 500 miles in Texas, are here conferring with the Chicago & Alton Railroad officials, and have submitted a proposal that the latter extend their lines from Kansas City to the northern boundary of the Indian Territory; that the Gulf, Colorado & Santa Fe extend its line from Fort Worth to the Southern boundary of the Territory, and the two interests unite in a third company to build a line across the boundary 100 miles west of the Missouri, Kansas & Texas, each road to bear one-half of the expense and the Gulf Road to send 400,000 bales of cotton yearly over the Alton. The latter gave very little encouragement to the plan.

COMPLETION OF A SOUTHERN AIR-LINE.—The last spike was driven on Saturday evening last on the extension of the Shenandoah Valley Railroad, thus completing the line between Hagerstown, Md., and Roanoke, Va., where connection is made with the Norfolk & Western Railroad. Direct communication is now made between New York and New Orleans over this road. The line and its connections will be known as the Virginia, Georgia & Tennessee Air-Line. Movements of freight by this route will commence at once and the passenger schedule will go into effect on June 19.

KANSAS RAILROADS.—The State Auditor has completed the computation and distribution of the railroad property assessments for 1882. The assessment of all railroad property reaches the sum of $250,881,646, an increase of $21,416,156 over last year, or nearly 11 per cent. The total mileage of last year was 3,478; this year it is 3,698, an increase of 220 miles. The average assessment per mile of all property last year was $6,518; this year it is $6,515. The increase in mileage from March, 1880, to March, 1881, was 374 miles; from March, 1881, to March, 1882, 220 miles. Kansas has now 81 organized counties, 67 of which have railroads. Seven of the unorganized counties have railroads.

ENGINEERS are locating a railway from Seneca to Mendota, Ill., which is believed to be for the use of the Cincinnati, Indianapolis & Chicago road.

COST OF A ROAD.—The cost to the Chicago, Burlington & Quincy of building and equipping its Denver line will probably exceed $4,000,000. The roadbed, which is pronounced of superior construction, has cost at the rate of $17,000 per mile.

A NEW ROAD INTO TIOGA COUNTY.—WARSAW, N. Y., May 31.—To-day surveyors commenced running

the narrow-gauge line from Addison, Steuben County, N. Y., on the New York, Lake Erie & Western Railway, to Gaines, Tioga County, Penna., a distance of 40 miles. This is to be one of the many feeders the Erie road has in process of construction all along its line in order to hold business up to the present standard when the new trunk lines go into operation. Richard G. Taylor, of Buffalo, will be its President.

RAILROAD BUILDING IN CENTRAL AMERICA.—PANAMA, May 24.—The Republic of Salvador is making its first essay in railroad building, and the line from Acajutla to Sonsonate will be opened this month. Although the capital subscribed is altogether local, the enterprise may be regarded as a regular American affair. American engineers ran the lines originally and superintended the construction. Cross-ties and rails were imported from the United States, and only the other day the rolling stock was landed from California—two locomotives and a number of cars of different descriptions. The new road will be under the superintendence of Mr. Robert Nanne.

Considerable interest is felt in the success of another railroad enterprise, a concession for which was granted to General Butterfield, of New York, some months ago. It is known as the "Central Railroad of Salvador." Starting from the capital it traverses the central valleys of the republic, passing by the celebrated lake of Idopango, the cities of Cojutepeque, San Vincent and San Miguel, and making its terminal point at La Union on the Gulf of Fonseca. The government of Nicaragua is organizing two colleges for young ladies, one in Leon and the other in Granada. Sir George Kellner, Mr. Bush and Mr. Menghens, the commissioners of the English bondholders, have returned and accepted the proposition made by the council of foreign bondholders by General Guardia last year This is to complete the road from Rio Sucio to San Jose, under certain conditions, and to operate the same for a certain fixed period. Coffee continues to arrive at Port Limon from the interior, and several thousand sacks are expected there this month.—*New York World.*

INCORPORATED.—DES MOINES, Iowa, May 30.—The Davenport, Iowa and Dakota Railroad, capital 8,000,000, has obtained a legal existence by the filing of articles of incorporation with the Secretary of State.

RAILROAD INCORPORATED.—Articles of incorporation of the St. Croix & Chippewa River Railroad Company were filed with the Secretary of State of Wisconsin. The railroad is to be constructed between a point on the Chippewa River at or near Durand. The length will be about fifty miles. The amount of capital stock will be $500,000.

NEW YORK & BOSTON INLAND.—The Boston *Advertiser* says: "The route now sketched for the projected Boston & New York Inland Railroad to enter this city leaves the line of that originally contemplated at a point where the city of Newton and the towns of Dedham and Needham come together, and thence continues down through West Roxbury and connects with tracks of the West Roxbury branch of the Providence Railroad at a point near what is known as Central Station. In West Roxbury the location, as contemplated, passes directly through the property which was at one time known as the Brook farm. This property is now owned by a German benevolent organization, and is known as the Martin Luther Home. The line enters the West Roxbury District on the estate of George Kempton, near the line separating it from the estate of W. R. Wheeler, and thence continuing, crosses in the order named the following estates and streets: I. D. Richards, Patrick Tracy, Martin Luther Orphan Home, John Cunningham, Baker street, Thomas Cunningham, Lagrange street, A. F. Whittemore (five estates), George H. Burditt, Oak street, James A. Whittemore, Corey street, George H. Gooding, Center street, N. L. Chamberlain, heirs of C. Woodward, Betsey Draper and Richard Dinnin, and joins the West Roxbury Branch of the Providence Railroad on the estate of Mary White, near Central station. The new location avoids Brookline and the Back Bay territory entirely. The engineer of the new road estimates the cost of constructing the 69¼ miles of road in the state of Massachusetts at $4,775,143."

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BUILDINGS.

OPERA-HOUSE.—Council Bluffs, Ia., is talking of an opera-house, to cost between $40,000 and $50,000.

A GRAIN ELEVATOR is to be built at Whitehall, Wis.

CITY HALL.—Richmond, Va., has voted $300,000 for a new city hall.

NEW YORK CITY CONTRACTS.—Bids were opened on May 1 by the Fire Commissioners for the building of new houses for engine companies Nos. 6, 10 and 33. The lowest bids for the three houses, which were referred to the Controller before making awards, were as follows: Engine Company No. 6, at No. 100 Cedar street, $12,255; No. 10, at No. 8 Stone street, $14,500, and No. 33, at No. 15 Great Jones street, $18,000.

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THE Muskegon strike has cost about $750,000, it is understood, and the loss falls like the rains of Heaven—alike upon the just and the unjust.

EXTENSIVE STRIKES IN THE IRON TRADE.—All the mills in Mahoning valley, in Ohio, refused to sign the wages schedule and no work will be done at any of them. The strike will throw ten thousand men out.

Seven rolling mills in the neighborhood of Cincinnati shut down, and 5,000 men are out of employment. The boilermen demand that the mill-owners sign a new contract. The latter refused. The shut-down extends to Cleveland.

At Pittsburgh thirty-six iron mills shut down June 1, and 18,000 men are out of employment. Five mills signed the scale May 31, but it is not thought this will affect the general situation.

The Laclede Rolling Mills, Heilbacker Forge and Harrison Wire Works, at St. Louis, shut down June 1 in consequence of the difficulty with the workmen.

The iron and nail mills at Wheeling shut down May 31, the proprietors refusing to sign the new schedule. Five thousand men are thrown out there.

CONTRACTS LET.

IRON-WORK FOR BUILDINGS.—The Albany (N. Y.) Architectural Iron-Works have received the contract for all of the iron-work to be used in the construction of five large buildings to be erected at St. Johns, N. B.

DITCH CONTRACT LET.—The contract for digging the six-mile ditch recently advertised in this journal was sold at Wapakoneta, O., on the 27th ult., to nine contractors. The aggregate price was $4,241.10.

CHURCH CONTRACT LET.—Contracts were signed at Boston for the construction of the main building of the People's Church, at a cost of $150,000. The building will be the largest church edifice in New England

ELECTRIC LIGHT CONTRACT.—The city of Springfield, Mass., has contracted for 16 electric street lamps, to burn from dark until midnight, for $3,300 a year, payable in monthly installments. The company offers to continue burning the lamps till 3 o'clock a. m. for $699 additional.

THE contract to build the Huntingdon, Pa., Reformatory has been let to Mr. Shenk, of Erie, his bid being $133,790.

HUNTINGTON, Ind., May 30.—Contracts on the Chicago & Atlantic Railroad have been let as follows: Bridging, Cleveland Iron Bridge Company; tracklaying, George B. Harris; fencing, Cleveland Barbed Wire Fence Company.

ARTESIAN WELL CONTRACT LET.—The city council of Peoria, Ill., let the contract for putting down a test artesian well to Marrs & Miller, of Chicago, and ordered the work done at the water-works, instead of the old fair grounds, as heretofore contemplated. The contractors agree to furnish everything except boiler and steam. The surface pipe, which is to extend downward to bed rock, is to be of quarter-inch wrought iron, six inches in diameter inside. The size of the bore through rock is to be not less than five inches, so as readily to admit a four-inch galvanized iron pipe with necessary couplings to any depth designated by the committee in charge of the work. The work is to be pushed forward with all possible dispatch, day and night, and the price to be paid depends upon the depth of the well. If it stops at 1,000 feet the price is to be $2.25 per foot. From that depth to 1,250 feet, the price is to be $2.50; from that to 1,500, $3; from the latter to 1,750, $3.50; from that to 2,000, $4; from 2,000 to 2,250, $4.50; from 2,250 to 2,500, $5; from 2,500 to 2,700, $6; and so on up to 4,000 feet, the last 250 of which would cost $12 per foot.

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NEW LINE TO BRAZIL.—The United States and Brazil Mail Steamship Line is the name of a new line of steamers to run semi-monthly between the United States and the South American ports of Para, Maranham, Pernambuco, Bahia, Rio de Janeiro, and Santos, stopping at St. Thomas. The company has three iron steamships now building at Roach's yards at Chester, Pa., each vessel having accommodations for 50 cabin passengers and unusually complete freight arrangements. Light freights and express parcels will be taken from South America for Europe, via New York, on through bills of lading, and express parcels will be carried from New York to South American points. The offices of the company are in this city.

the narrow-gauge line from Addison, Steuben County, N. Y., on the New York, Lake Erie & Western Railway, to Gaines, Tioga County, Penna., a distance of 40 miles. This is to be one of the many feeders the Erie road has in process of construction all along its line in order to hold business up to the present standard when the new trunk lines go into operation. Richard G. Taylor, of Buffalo, will be its President.

RAILROAD BUILDING IN CENTRAL AMERICA.—PANAMA, May 24.—The Republic of Salvador is making its first essay in railroad building, and the line from Acajutla to Sonsonate will be opened this month. Although the capital subscribed is altogether local, the enterprise may be regarded as a regular American affair. American engineers ran the lines originally and superintended the construction. Cross-ties and rails were imported from the United States, and only the other day the rolling stock was landed from California—two locomotives and a number of cars of different descriptions. The new road will be under the superintendence of Mr. Robert Nanne.

Considerable interest is felt in the success of another railroad enterprise, a concession for which was granted to General Butterfield, of New York, some months ago. It is known as the "Central Railroad of Salvador." Starting from the capital it traverses the central valleys of the republic, passing by the celebrated lake of Idopango, the cities of Cojutepeque, San Vincent and San Miguel, and making its terminal point at La Union on the Gulf of Fonseca. The government of Nicaragua is organizing two colleges for young ladies, one in Leon and the other in Granada. Sir George Kellner, Mr. Bush and Mr. Menghens, the commissioners of the English bondholders, have returned and accepted the proposition made by the council of foreign bondholders by General Guardia last year This is to complete the road from Rio Sucio to San Jose, under certain conditions, and to operate the same for a certain fixed period. Coffee continues to arrive at Port Limon from the interior, and several thousand sacks are expected there this month.—*New York World.*

INCORPORATED.—DES MOINES, Iowa, May 30.—The Davenport, Iowa and Dakota Railroad, capital 8,000,000, has obtained a legal existence by the filling of articles of incorporation with the Secretary of State.

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